The

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The Trading Clause.

THE announcement of the names of the gentlemen who have been approved by the Electricity Commissioners as members of the Committee which is to deal with the celebrated Section 48 of the Electricity (Supply) Act, reached us too late for us to make any comment upon the matter in our last issue. We were obliged to be content with the mere statement of the *personnel* and its objective, which is "to determine any question which may be raised under Section 48 of the Act as to the recognised retail or trade prices of any electrical fittings and to advise and assist the persons concerned as to the method of giving effect to the provisions of the Section."

Twenty representatives of the various sections of the industry and trade who have an interest in the aforesaid matter will be presided over by Mr. D. N. Dunlop, Director of the B.E.A.M.A. The municipalities, the electrical manufacturers, electric light fixtures and accessories manufacturers, the electric lamp-makers, the cable-makers, the wholesalers, and the electrical contractors, will all be there, while the Scottish electrical contractors have two representatives of their very own.

Those who are familiar with the long struggle that has taken place in the industry know only too well how difficult and at times almost despairing has been the problem of bringing a spirit of compromise into existence. They will be quite ready to allot praise wherever it may be due for heroic efforts made to remove stumbling blocks that have persistently appeared in the pathway of negotiation, and a number of names given in the list of members of the new committee might be selected by us here for the purpose of giving credit to several gentlemen whose services proved particularly useful in bringing matters to the present promising position. Mr. Phillips, in his presidential address to the I.M.E.A., singled out Mr. A. C. Cramb as the one to be especially congratulated

for services rendered to the municipal electricity supply interests by bringing the question of selling powers to a successful conclusion. If there had been spokesmen on behalf of the manufacturers and the contractors, other names would have been mentioned as having exercised no less important or less assiduous influence in their own particular sphere both inside electrical circles as tactful negotiators and outside as diplomatic representatives. But while expressing gratification at the setting-up of the Committee and satisfaction with its *personnel*, let us not imagine that our work is finished. In actual fact it is only about to begin. Mr. Phillips, whom we quoted last week, remarked that "he thought" that the problem of the complete accomplishment of co-operation between the supply and electrical contracting branches of the industry was "approaching solution." Memory, if nothing more, must make us all equally guarded, however optimistic we may be. But we can at any rate take heart from the fact that the spirit of co-operation has led us thus far and "the excellent spirit evinced by all parties to the negotiations" fructuated in Section 48. Without that spirit there could have been no such clause—perhaps we do not all know how near we came to actually losing it; and if one thing is more certain than another now that we have it, it is that that spirit of co-operation which has stood us in such good stead must, as Mr. Phillips remarked, be maintained and strengthened in operating the Section.

There have been few more important electrical committees appointed in recent years, and none can do more than this one to smooth out the way for fuller domestic electrical development. That there will be many difficulties to meet is certain, but if this Committee cannot find a way to overcome them no other body of men can do so. Specialised experts as they are, however, not one of them will be able to contribute to the practical solution of the problem if he fail in respect of the spirit of co-operation.

The I.M.E.A. Convention.

The fact that the annual Convention of the Incorporated Municipal Electrical Association which was held last week was the thirty-second of its order did not deter a speaker at the dinner from referring to the infancy of electricity; but the record attendance bore witness to the constantly growing vigour and importance of the industry, suggesting that it was at least approaching maturity. Mr. R. W. L. Phillips, retiring after an exceptionally strenuous year of office, is to be congratulated upon the very successful Convention over which he has presided, and his successor, Mr. F. W. Purse, is likewise to be congratulated upon attaining a position which will afford him the fullest opportunity to employ his undoubted talents in the interests of the Association and of the electricity supply industry.

The papers and discussions at the Buxton Conference were of a high order, on the whole, and will provide much food for thought. Mr. W. C. Bexon's able and comprehensive review of the problem of electricity supply over a large area was particularly useful in view of the developments foreshadowed under the Government scheme, especially in respect of the difficulties that the supply engineer has to contend with, and the convenient list of much-needed amendments which he appended to his paper was cordially approved in the discussion. It is singular that whilst the Government scheme was specifically designed to hasten the provision of a cheap and universal supply of electricity, no attempt was made in the Electricity (Supply) Bill to clear the obstacles out of the way, although attention had been repeatedly drawn to the importance of this matter. Whilst further legislation is not likely to be introduced for some considerable time, much could be done by the Electricity Commissioners, not only relaxing the stringency of their regulations, but also, as Captain J. M. Donaldson suggested, by providing explanatory memoranda and official documents; where a local engineer or manager can make little headway against misguided opposition, a Government department can bring powerful influence to bear without either exceeding its powers or incurring expense.

Mr. T. Roles passed in review the many new developments in the design of generating plant which have taken shape during the past ten years, and which, though slowly carried into effect, bid fair to produce fundamental changes in central-station practice. We have already referred to the experimental character of some of the new departures, which has caused the designers of new power stations supplying large communities to adhere to standard practice for the sake of unquestionable reliability and continuity of service, a consideration of the utmost importance; but history teaches that progress must inevitably continue, and Mr. Roles himself has the proud distinction of leading the way in this country with the 1,100-lb. per sq. in. steam plant that he is installing at Bradford. All the more credit attaches to this bold step in view of the difficulty experienced by engineers in municipal service in securing authority to depart from the beaten track, and the Bradford Electricity Committee deserves the thanks of the electrical engineering industry for adopting so progressive and enterprising a policy. Mr. Roles quoted from the admirable paper read by Mr. H. L. Guy before the Institution of Mechanical Engineers, on "The Economic Value of Increased Steam Pressure," which we judged to be of so much importance that we recently reproduced almost the whole of it in our pages.

Mr. H. H. Berry read his paper on the "Electrified Homes of Great Britain" with, we believe, the spirit of a martyr, for it was common knowledge that the policy which he advocated was highly distasteful to many of the members—being, in fact, described as anti-propaganda; however, he was not roughly handled, and the discussion was notable for the enthusiasm and ability displayed by the women who took part in it. We think the I.M.E.A. is doing good service by inviting the Electrical Association for Women to participate in the Convention; the E.A.W. is still a newcomer in the electrical field, and its members keenly appreciate the opportunity of conferring with the senior Association and expressing their views on domestic electricity supply in public debate.

The Birthday Honours.

Though electricity and electrical developments have occupied a foremost place amongst public questions and affairs during the past year, nobody will accuse the powers that be of distributing the King's Birthday honours with a prodigal hand to those connected with either the science or the industry. In conferring the distinction of Order of Merit upon Sir C. A. Parsons, F.R.S., His Majesty has given further national recognition to the genius and achievement of an engineer whose work has been of immense value not only to British power station engineering, but has contributed magnificently to the glory and prestige of British engineers wherever the turbine has found its way on or by land and sea. In every engineering circle there will be full approval and satisfaction at the inclusion of Sir Charles Parsons in the number of those who wear the rare and much-coveted Order of Merit. To some it may seem that it has come later than it should, but the timeliness of it in view of the national trust in new power-station activity is beyond question. The second outstanding electrical name in the Birthday List is connected with the commercial rather than the engineering side of electricity development—we refer to Sir Harry Benedetto Renwick, K.B.E., who is made a Baronet "for political and public services in connection with electricity schemes" (to quote *The Times*). Sir Harry is the chairman of the County of London Electric Supply Co., Ltd., which owns the Barking power station, which was opened by His Majesty. We give the names of other gentlemen who have received recognition of their public and other services in this year's List, in our "Personal" column.

Stourport Electric Power Station.

A new 25-cycle capital generating station capable of extension to an ultimate capacity of 250,000 kW, designed to serve, in conjunction with other plant, the Central England district, a scheme for which is being prepared by the Electricity Commission.

INCORPORATED in 1903, the Shropshire, Worcestershire and Staffordshire Electric Power Co. has grown to be amongst the largest undertakings of its kind in this country. Its distribution area includes both rural and industrial districts, covering practically the whole of Worcestershire, the southern portion of Shropshire, and portions of South Staffordshire; it has further been entrusted with the task of supplying electricity in the "Avon Valley" area, which includes parts of north Gloucestershire and south-west Warwickshire, a total of about 1,412 sq. miles. To meet the increasing needs of the area a new capital station at Stourport was formally inaugurated on June 2nd by Mr. Stanley Baldwin, Prime Minister, in the presence of a distinguished gathering numbering some 1,500 persons, who were received by Mr. E. Garcke, chairman of directors, Mr. W. G. Bond, managing director, and Mr. J. T. H. Legge, chief engineer, of the Company.

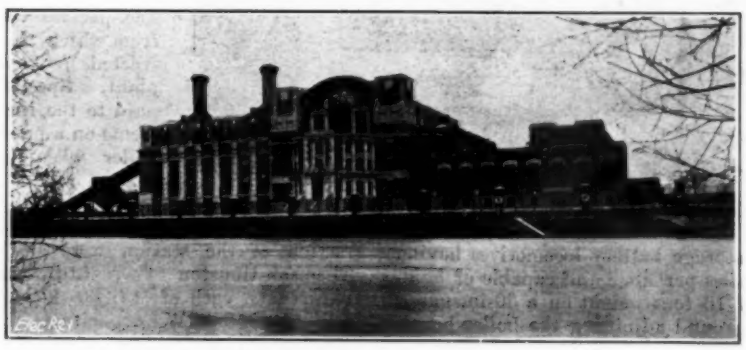


Fig. 1.—The New Stourport Generating Station.

river, whilst the amount of water available will permit of the plant being developed to a capacity of 250,000 kW without the use of cooling towers; a minimum of 240 million gallons per day is obtainable. Resting on sandstone rock 14 ft. below the surface of the ground, the foundations consist of Raymond piles (composed of concrete poured into reinforced steel shells previously driven on mandrels) in groups, the tops of which are bound together by reinforced-concrete beams, on which a reinforced-concrete raft is superimposed in sections to allow for expansion which is expected to result from the periodical saturation of the ground when the river flow is at its maximum. The steel-framed brick superstructure has ferro-concrete floors and the roofs are supported on "Siegwart" pre-cast hollow concrete beams.

The building work was carried out by the Mitchell Conveyor and Transporter Co., Ltd., which also supplied the coal- and ash-handling installations, each unit

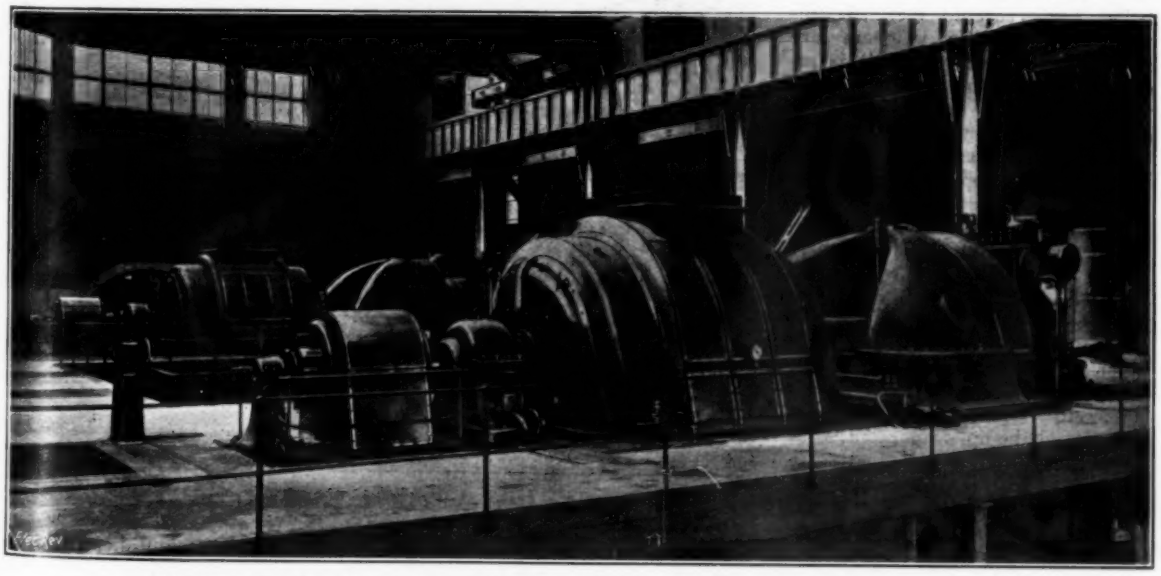


Fig. 2.—The First Two 25-cycle, 3-phase, 1,500-r.p.m., 5,500-V, 18,000-kW Steam Turbo-generators Installed.

The 32-acre site of the station, with 20 adjoining acres affording access to the docks of the Staffordshire and Worcestershire Canal Co. and the Great Western Railway, at the confluence of the Rivers Stour and Severn, is favourably situated for the delivery of fuel from the Midland coal fields *via* canal, railway, and

of which can handle 50 tons per hour, but slight modification will increase its capacity to 100 tons per hour. The coal is unloaded from barges in the canal basin by grabs operated from two travelling jib cranes, discharging on to two collecting conveyors running parallel to the quay, through receiving hoppers on to a second

series of ball-bearing 24-in. belts that carry the coal over the public road to a transit storage bunker; the cranes are electrically driven, the hoisting, slueing, and travelling motions being each operated by a separate motor. The 250-ton ferro-concrete transit bunker, which is divided longitudinally to hold two classes of coal, feeds the coal through chutes to wagons drawn by

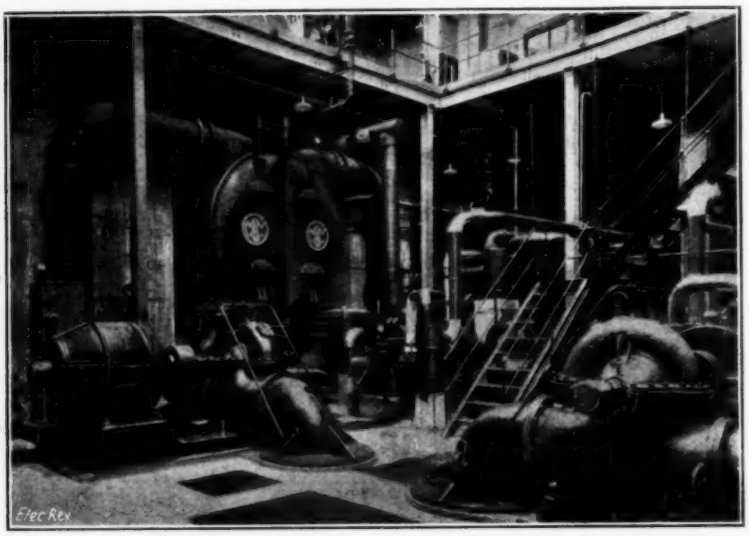


Fig. 3.—A 25,000-sq. ft. Condenser and Auxiliary Plant.

"English Electric" storage battery locomotives having a speed of over six miles per hour and capable of hauling a loaded train of 18 tons weight on a 30-in. gauge track to the storage ground adjoining the boiler house. At this point the wagons discharge through hoppers at ground level on to the storage conveyor by means of which the coal is stored by a butterfly stacker fed from the main conveyor that feeds the raised hopper, by means of which reclaimed coal is returned to wagons. A re-claiming travelling jib grab crane runs parallel to the stacking conveyors and is used for trimming the coal and also for re-discharging either to wagons or direct to the boiler house covered inclined conveyors. Automatic weighers are fitted at each point where it is required to know the amount of coal passing, whether into stock, from stock, into the bunkers, or from the barges. All ash leaves the dumping bars through hoppers into a water trough, from which it is carried by a drag link conveyor to a special hopper for transferring to ash wagons.

The steam-raising equipment, supplied by the Stirling Boiler Co., Ltd., comprises four "tri-drum" water-tube boilers with Stirling superheaters and Babcock & Wilcox economisers. The feed-water system is closed, Weir pumps being used and the make-up evaporated, with preliminary heaters supplied with steam bled from the turbines; provision is also made for utilising live steam from the boilers for this purpose. At a temperature of 150 deg. F. the water enters the economisers and is raised to 250 deg. F. before entering the boilers, a steady feed being maintained by Cope automatic regulators. Each boiler has 10,000 sq. ft. of heating surface, and is normally capable of evaporating 60,000 lb. of water per hour to steam at 350 lb. per sq. in. pressure, superheated to 686 deg. F.; under overload conditions, the four boilers are capable of supplying 320,000 lb. of steam per hour at the aforementioned pressure and temperature, and under each are two Babcock & Wilcox component-type chain-grate stokers, with a combined grate area of 324 sq. ft. One "Sirocco" forced-draught and one induced-draught fan are fitted per boiler and the flue gases pass through Davidson dust collectors situated at the bases of the two chimneys.

In addition, each boiler is equipped with six pressure jet oil burners, designed to obtain 30 per cent. of the normal evaporation of the boiler. One of these burners is fitted in the front of each mechanical stoker, and so arranged that sufficient temperature can at any time be obtained for the ignition of low-grade fuel. The oil installation is primarily incorporated to meet sudden demands for steam, thereby dispensing with the necessity of keeping stand-by boilers. Avery automatic weighing machines are provided on each stoker hopper, specially designed for weighing wet slack; besides Diamond soot blowers, soot pockets are also being provided from which the flue dust will be extracted by Smith & Yates suction plant. Special attention has been paid to the incorporation of instruments on a panel at the front of each boiler with the starters and shunt regulators for the motor fans situated immediately beneath.

The turbo-generators in the first section of the station were supplied by the British Thomson-Houston Co., Ltd., and consist of two main sets each of 18,000 kW and a house-service set of 750 kW capacity. Each of the main single-cylinder turbines of the impulse 17-stage type runs at 1,500 r.p.m. and drives an alternator having a maximum continuous rating of 22,500 kVA, 80 per cent. power factor, generating three-phase current at 25 cycles, 5,500 volts. Mounted on each alternator shaft is an auxilliary shunt-wound d.c. generator rated at 250 kW, 460 volts, connected through a control pillar to the auxiliary circuits for the condenser pumps, thus each turbo set is self-contained and is provided with an auxiliary turbine-driven oil pump, a main governor arranged for motor operation at 230 volts d.c. and an emergency governor with an electrical tripping device on the switchboard. Each alternator is provided with a direct-coupled exciter, and the stator frame is hollow in section, the space between the outer

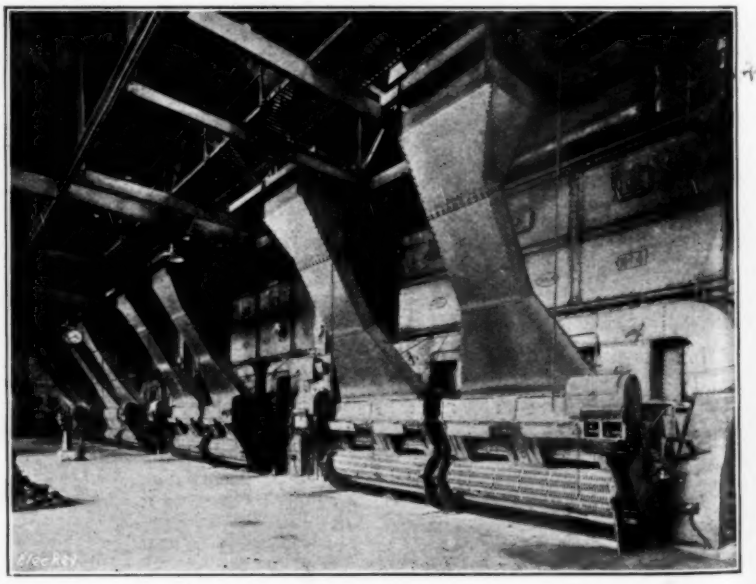


Fig. 4.—The four 60,000-lb. "Tri-drum" Boilers.

shell and the core laminations forming a chamber from which the heated air passes to the coolers in the foundation. A complete system of distance-temperature thermometers was supplied by the Cambridge Instrument Company, Limited.

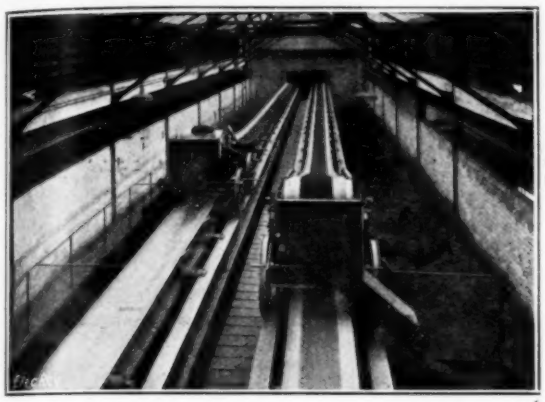


Fig. 5.—Boiler-house Coal Conveyors over Bunkers.

All the condensing plant was manufactured by Cole, Marchant & Morley, Ltd., to maintain a 29-in. vacuum when dealing with 150,000 lb. of steam per hour with circulating water at the rate of 1,050,000 gallons per hour at a temperature of 55 deg. F. Each condenser has a cooling surface of 25,000 sq. ft. and is of the two-flow type, with divided water heads, so that one half of the tubes can be cleaned without shutting down the plant. Each is provided with a duplicate set of steam-jet Delas air extractors. The extraction and lift pumps are also in duplicate, one being driven by a 32-h.p. d.c. motor at 460 volts, and the other by a small vertical turbine. There are two Mather & Platt circulating-water pumps, each capable of dealing with 63,000 gallons of water per hour; one is driven by a d.c. motor rated at 138 b.h.p., 460 volts, and arranged for speed variation from 615-685 r.p.m.; the other is driven by a B.T.-H. turbine rated at 138 b.h.p., 6,000 r.p.m., geared down to the pump speed of 650 r.p.m., and exhausting against 20 lb. absolute back pressure into the low-pressure heater in conjunction with the steam tapped from the main turbine. The two Weir condensate extraction pumps for each set are driven by a d.c. motor and a steam turbine, which also exhausts into the heater steam range: they discharge into the closed feed system; when the condensate temperature is 73 deg. F., the temperature rise due to passing through the air extractor heater is 7 deg., the temperature rise due to passing through the drain cooler heater is 2 deg., and the temperature rise due to passing through the main feed heater is 68 deg., the temperature of the condensate entering the boiler feed pumps being 150 deg. F.; feed heat can also be provided from the bleeder belt of the main turbine at 11 lb. per sq. in. absolute. Each plant is provided with a Weir evaporator for supplying make-up water to the system, the duty being 7,500 lb. of water per hour; steam is tapped off the high-pressure ends of the main turbines at a gauge pressure of 70 lb., but in the event of this supply not being available an auxiliary connection to each evaporator can be used for operating on live steam at 325 lb. pressure. A "cushion" tank is provided between the condenser and boilers; all drain recovery is led to this tank, which is connected to the top of the main condenser by a 3-in. pipe delivering make-up to the main condenser for de-aeration, after which such water is passed to the closed-feed system proper. *(To be concluded.)*

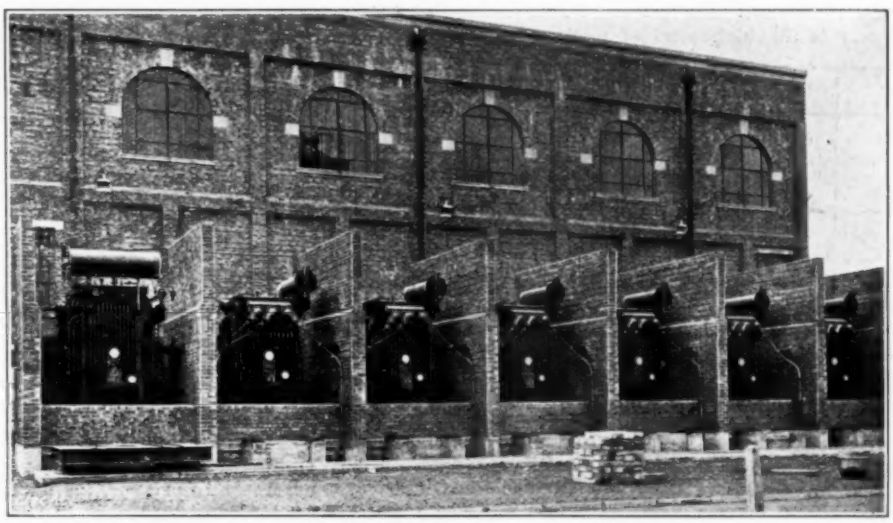


Fig. 6.—Three-phase 33,000/11,000-volt Outdoor-type Transformers.

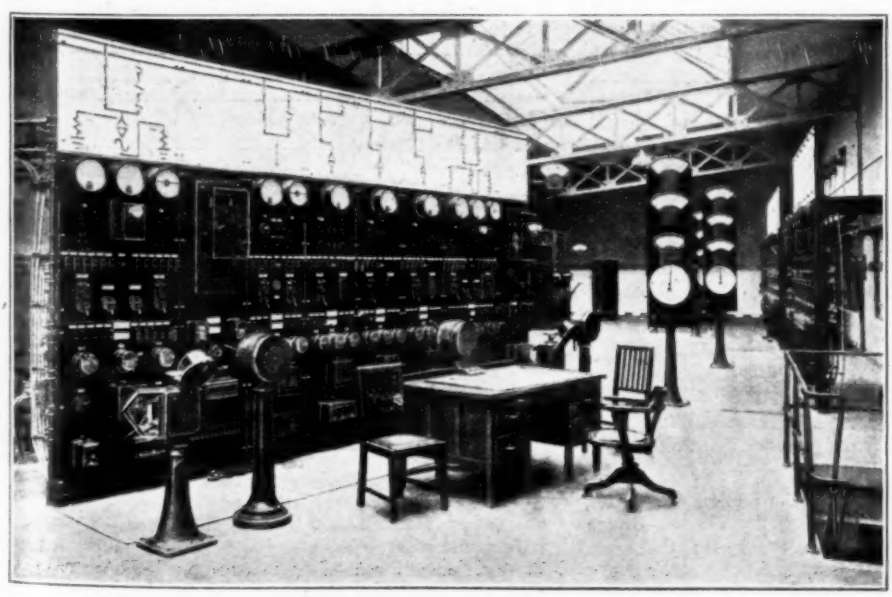


Fig. 7.—Main 33- and 11-kV Oil Switchgear Control Room.

Our Overseas Electrical Markets.

Trend of import trade of Australia, New Zealand, India, and Africa. Factors affecting purchasing power.

IN continuation of the survey of our principal overseas electrical markets which appeared in the ELECTRICAL REVIEW of January 21st, 1927, it is now possible to show the position during a further period of three or four months. The countries covered are Australia, New Zealand, India, and the Union of South Africa. With regard to Australia, greater detail can now be given than was available when the former survey was made; in addition to charting the trend of the import trade in cable and wire, that in dynamo-electric machines, filament lamps, and telegraph and telephone material is also recorded in fig. 1 since July of last year. Taken as a whole, it will be seen that the Commonwealth's import trade in electrical material is well maintained. The feature of New Zealand's record (fig. 2) is the high total of electrical machinery and

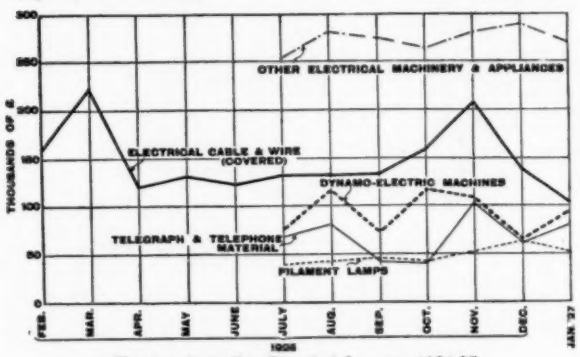

OTHER ELECTRICAL MACHINERY & APPLIANCES
ELECTRICAL CABLE & WIRE (COVERED)
DYNAMO-ELECTRIC MACHINES
TELEGRAPH & TELEPHONE MATERIAL
FILAMENT LAMPS
THOUSANDS OF £
FEB. MAR. APR. MAY JUNE JULY AUG. SEP. OCT. NOV. DEC. JAN. FEB.
1926
1927

Fig. 1.—Australian Electrical Imports, 1926-27.

equipment in December last, a smaller vertical scale is used for the total; only in one month (*i.e.*, March, 1925) during at least the past eighteen months has this level been surpassed. New Zealand's imports of telephones and accessories also reveal a healthy and regular upward tendency.

In India's electrical trade it is noticeable that while great Britain maintains her predominant position in

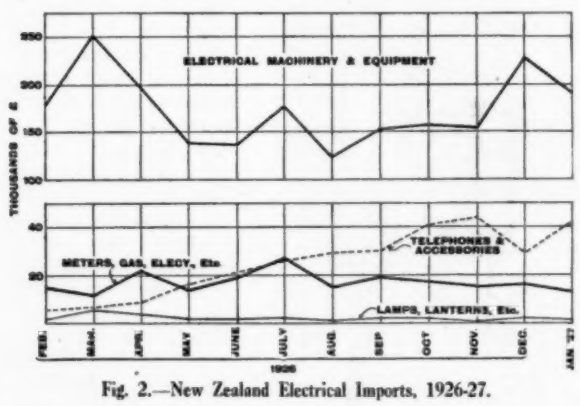

ELECTRICAL MACHINERY & EQUIPMENT
METERS, GAS, ELECY., Etc.
TELEPHONES & ACCESSORIES
LAMPS, LANTERNS, Etc.
THOUSANDS OF £
FEB. MAR. APR. MAY JUNE JULY AUG. SEP. OCT. NOV. DEC. JAN.
1926

Fig. 2.—New Zealand Electrical Imports, 1926-27.

the imports of telegraph, telephone, and other apparatus (fig. 3), without either Germany or the United States gaining any considerable permanent success; there are signs that the United States is still obtaining some good contracts for machinery (fig. 4). For convenience, in figs. 3 and 4, the sections showing the shares of Germany and the United States are on a larger vertical scale than those showing the total values and Great Britain's share.

With regard to the imports of the Union of South Africa (fig. 5), the noteworthy feature is the steady upward trend since the autumn.

It is hoped that a study of these charts will furnish manufacturers and exporters with some useful indications as to whether they have been obtaining their fair share of the business that is offering in these markets.

It will also be of utility to review factors affecting the general purchasing power of these countries.

Australia.

The natural increase in population in Australia, according to the latest statistics, is now the greatest in

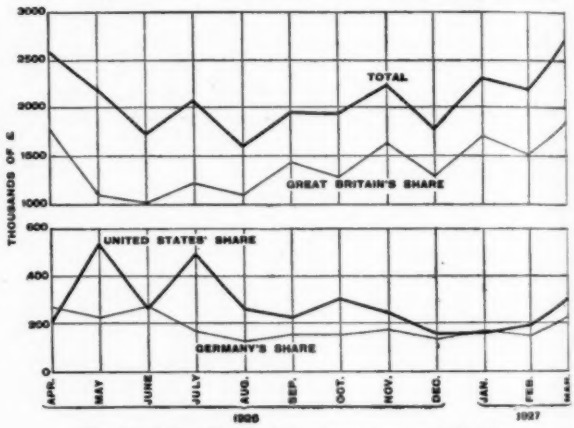


Fig. 3.—Indian Electrical Apparatus Imports, 1926-27.

the world relatively to the population. Wool growing continues to prosper, the number of sheep shorn in the 1926-27 season being 51,880,000, as compared with 45,550,000 in the previous year and 41,320,000 in 1924-25, and the average clip 8.8 lb. per sheep shorn as compared with 8.1 lb. and 8.25 lb. respectively. Producers have been fairly well satisfied so far with

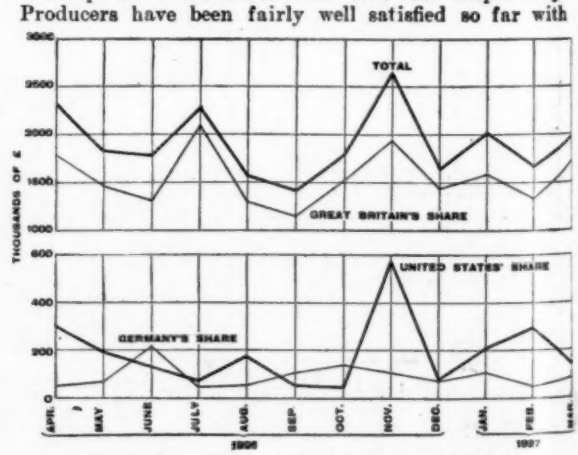


Fig. 4.—Indian Electrical Machinery Imports, 1926-27.

the prices realised. Although there has been a more than usually large adverse balance in the foreign trade of the Commonwealth, it is expected that, during the next few months, this will be much reduced owing to the large quantities of raw materials available for export. The 44-hour working week which is being introduced is a factor which will influence the prospects of import trade, as it will increase production costs. It is

believed also that it will reduce output. While the present wide gap between exports and imports exists, the bankers are inclined to curtail credits in order to check imports as far as possible.

The prospects for the wheat harvest are, on the whole, good, the forecast for South Australia showing a larger yield in bushels per acre than in the previous season, with a small increase in acreage. The estimate for Western Australia is also favourable, while that for

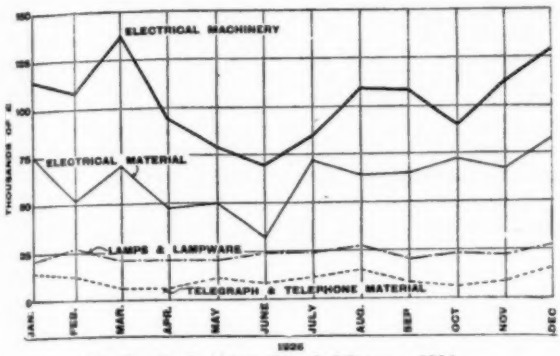


Fig. 5.—South African Electrical Imports, 1926.

New South Wales is 9 million bushels more than in 1925-26. Railway receipts have been advancing, while both the Commonwealth and State revenues are reported to be well ahead of estimates.

New Zealand.

Although the import market of New Zealand is quiet owing to large stocks, the position on the whole appears to be quite sound. A very satisfactory return is being received from the wool crop, but the prices of meat and dairy produce are a little disappointing. New Zealand's exports during the first two months of the year totalled £10,221,000 in value, and her imports £7,304,000. The corresponding figures for the same months of 1926 were £9,369,000 and £8,951,000.

Unemployment generally in March showed a small increase compared with February, and a considerable advance compared with about twelve months previously; in the engineering and mechanical trades, however, there was a decrease in March compared with February. A favourable feature is the decline in mid-February of 17 points in the index number of the cost of food, which, however, is still 46 per cent. over that for July, 1914, while including clothing and rent, the expenditure of 20s. before the war went as far as 32s. 6d. in February this year.

South Africa.

In South Africa the recent mining developments are now favourably affecting trade both wholesale and retail. The gold output for April, although showing a decrease on the previous month, was better than in April last year. The agricultural outlook is satisfactory in both the Transvaal and the Free State, and in the drought area in the West and South there has recently been a moderate rainfall. Business in iron and steel during April was brisk, and employment was good in the building trades and in industry generally. In the motor trade, which is an excellent barometer of the purchasing power of the country, improved sales are reported from Cape Town; while Johannesburg, Durban, and East London are buying much as usual; in Port Elizabeth, according to the report of the National Bank of South Africa, Ltd., sales of cheap cars are excellent.

The South African Railway Administration is making provision for handling more traffic in 1927-29 than in 1926-27. Mr. Malan, the Minister, recently stated that the railway workshops and machinery must be remodelled and extended and brought up to date; £15,000,000 has been mentioned as the sum to be spent.

India.

In India, the purchasing power of the ryot is improving, and he is more ready to spend than at any time during the past two or three years. Further improvement is expected to result from the Government schemes for encouraging cultivation. Meanwhile, this season's cotton crop is short in quantity and lower in value than the last. Jute also is yielding less favourable results, but, while the grain crops are doubtful, the exports of tea are satisfactory, and the oilseed crops promise well.

During the current financial year it is hoped to complete 900 miles of new railways at an expenditure of about £10,000,000. Details are believed to have been worked out and are expected to be issued shortly of a scheme for the electrification of the suburban services of the Eastern Bengal railway. The conversion of the North Western railway is proceeding, the next parts to be undertaken being Lyallpur, Sukkur, and Rohri.

A cable from the United States Trade Commissioner in Calcutta reports that the engineering trade is improving.

E.H.P. Transmission.

Some considerations on the possible causes of faults on e.h.p. cables and systems, referring particularly to 33,000-V belted-type cable.

By G. W. PRESTON.

SUPER-pressure transmission is of ever-increasing importance; not only are high voltages essential for the transmission of moderate amounts of power over long distances, they would seem to be desirable for the transmission of very large amounts over comparatively short distances. If the latter proves to be the case and a great multiplicity of cables is to be avoided, it will lead to the development of larger sizes of cable than are generally employed at present.

While three-core super-pressure cables of .35-sq. in. section have been laid, .25 sq. in. is more generally looked upon as being a desirable size. On account of the greater overall diameter of the larger sizes of cable, and of their greater rigidity, the employment of some sort of metallic binder on the cores would seem to be essential, both from the point of view of the mechanical support which it would give to the paper to prevent puckering, and of the increased potential gradient, with a reduction of dielectric thickness, made possible by the presence of such a metallic wrapping, potential gradients of as much as 5,000 volts per mm. being possible.

Unfortunately the performance of the ordinary type

of belted three-core, 33,000-V cable (I do not refer to cables of the "H" or "S.L." types) has not been entirely satisfactory during the past few years. While a considerable amount of research work has been carried out in the laboratory in an endeavour to produce a satisfactory 33,000-V cable, it has become increasingly evident that certain factors in the breakdown of such a cable in service have not as yet been reproducible in the laboratory.

Although the greatest care is exercised both in manufacture and in the subsequent handling of the cable, which is subjected to thorough d.c. and a.c. pressure tests, due precaution being taken that such tests are not injurious to the cable, after thus having been proved capable of withstanding at least twice its ordinary working pressure it breaks down after only a few months of service.

It is evident from the fact that a period of time elapses before breakdown occurs, that some time-voltage relationship exists with which the cumulative effects of frequent surges and pressure rises, due to switching operations or faults on other branches of the system, combine to produce a gradual deterioration of the dielectric. The fact that a cable is frequently not loaded to its fullest extent until some time after it is put into service may in some measure also account for this lapse of time. The damaging effects of a fault on other cables connected to the same system are especially evident in the case of a cable running in parallel with the faulty one, a fault on the one cable being frequently followed by a fault on the other. It is possible that the shock thus sustained by the second cable might have no permanent effect if the cable were allowed to rest for a short period. The reverse to this usually occurs, the cable being called upon to carry the combined loads of the two cables while the fault is being repaired.

Not only may damage be caused by pressure surges when a fault occurs, but so large are the forces brought into play by the sudden dissipation of the enormous amounts of energy that, even with the most sensitive protective devices, permanent damage is probably caused to the sound portions of the faulty cable.

It has been found that 33,000-V cables have proved particularly liable to failure where they have been laid in cast-iron pipes. These failures have occurred not only in the pipes, but in their vicinity, and could be due to a number of causes. The cable may be mechanically damaged during pulling operations, this being particularly liable to occur when the pipe run is not straight, especially if the deviation is in two planes simultaneously. In such cases there is a danger of the cores being separated and voids formed at the weakest point of the dielectric.

The dissipation of heat from the cable in the pipe is less than when the cable is laid direct in the ground, and although it is common practice to lay cable of larger section in pipes, the lower thermal conductivity of the air in the pipe combined with the fact that the cables are usually laid at a greater depth, often in concrete, at points where pipes are used, may account for a rise of temperature at these points. Such an increase of temperature would have an adverse effect upon the dielectric, and would cause an increased expansion of the coppers, which, if no provision were made to counteract it, might produce a distortion of the cores.

It is just possible, however, that the explanation is purely electrical. On the occurrence of a fault, a heavy out-of-balance current would flow, setting up a magnetic field external to the cable. Under these conditions the sudden rush of current encountering an increased reactance due to the inductance of the iron pipe surrounding the cable might cause a sudden rise of pressure in the cable at these points, resulting in damage to the dielectric. Although this might not produce immediate failure, it would lead to a breakdown soon after the cable was again put into service.

A considerable number of failures have been found to occur at times of light load, such as at week-ends and in the early morning. The cause of this is not very clear, though it is evidently due to the cooling of the cable at these times. The contraction of the impregnating compound may cause it to drain away from a portion of the dielectric where deterioration has already commenced, thus encouraging the extension of charring and the eventual linking-up of two such spots, causing final breakdown. Secondly, as the cable cools, it is possible that the contraction causes a reduction of the internal pressure of the compound, and any air in the dielectric becomes more easily ionised, resulting in breakdown at a previously weakened spot.

Some investigators have noted that the internal discharge in a high-voltage cable under test has been clearly audible, it having been possible to note the period of the test at which this has occurred. It would be interesting to conduct a series of tests to determine the effect on this audible period of discharge of maintaining the compound in the cable at various pressures.

The question of the exact composition of the impregnating compound is a matter on which great differences of opinion exist. A compound should be sufficiently viscous to prevent any undue flow on gradients, which sets up a danger of the high points of the cable draining dry, the head of compound at the same time exerting considerable pressure on the lower portions of the lead sheathing. While impregnation is somewhat more difficult with a viscous compound, more compound can be retained finally in the paper, and it is less liable to be expelled under the influence of the electric field. The compound, if expelled, however, must be sufficiently mobile to flow back again as soon as the stresses are relaxed.

The mobility of a fluid type of compound, if properly taken into account, could be turned to effective use, and would seem to possess decided advantages. If adequate provision is made by installing reservoir and diaphragm joints on all gradients, and the lead sheath is effectively strengthened, the compound in the cable can be maintained under a definite pressure.

Fluid compound under pressure would have beneficial effects on the insulation. It would be less liable to expulsion from the paper, and would require a minimum period of relaxed electrical pressure to refill the insulation. At all places the cable would be well filled with compound, and any voids caused by the distortion of the cores during laying or by heating and cooling would tend to fill up. The compact between the cores and packings would be greatly improved, a point of great importance in view of the stresses to which these portions of the cable are subjected. Any air included in the insulation would be maintained under pressure and the ionisation potential increased.

The fluid-compound idea can be further developed, the cable being provided with definite oil ducts and actually filled with a fluid compound under pressure *in situ*, after the cable has been laid. The cable may, of course, be so strengthened by the addition of metallic binders as to reduce the risk of distorting the cores or the puckering of the paper to a minimum, though such cables as of the "H" or "S.L." types and the one mentioned above tend rather to counteract the effect of core distortion than to prevent it.

The fact that in many cases faults have occurred in groups, being confined to comparatively short lengths of the total run, might be accounted for in several ways. Adverse local conditions at these places, both from the point of view of laying and of subsequent performance, are probably the chief factors in these failures. The possibility of the lengths of cable affected being of faulty manufacture would account for a number of faults occurring on the same factory lengths, though the local effects of one fault on another are in all probability more largely responsible. A theory that peculiarities of the system as a whole might render certain points particularly susceptible to transient disturbances is at present without confirmation.

Fortunately the jointing of 33,000-V cables to-day presents little difficulty, the failure of well designed and carefully made joints being very rare.

The Power Supply of Wireless Sets.

An account of the experiences of an engineer when choosing a high-voltage battery eliminator for his wireless set: almost any of the better-class instruments will operate the average receiver with satisfaction.

By G. F. J.

INSPIRED by some notes in the REVIEW on the subject of the power supply for broadcast radio-telephone receivers, we tentatively decided to try an "eliminator" in place of batteries for energising the valve-plate circuit of a receiving set.

Inquiry from radio manufacturers and dealers in the City revealed a wide choice available, ranging in price from about £3 15s. to £12. (A.c. mains only being available where the set is operated, these notes will, of course, apply directly to that type.)

Eliminator No. 1.—We were first much impressed by the product of a Leicester firm, priced at about £8. We called on a dealer in the centre of the City, and asked to have one demonstrated: the dealer did not seem over-keen, but finally connected the instrument to a 3-valve receiver working on the local station. Results seemed good, but when reception from other stations was attempted, a certain amount of hum was heard. When it was pointed out to the dealer, he admitted it, and gave the vague explanation of "the trams" and "lift motors a door or so away" as the cause.

On requesting permission to try one on our own set, it was declined, with the remark that the manufacturers would not allow retailers to have goods on approval and, in all fairness, they could not allow their customers to do so. The assistant did not know the a.c. consumption of the instrument, or the life of the valve used for rectification, or the maximum d.c. output.

However, another dealer was found in a neighbouring town who was also a keen experimenter, and he gave us the chance of testing one at home. The a.c. consumption was found to be about 20 watts, the maximum output at 100 volts was 15 milliamperes, and there was a single fixed "detector tap" at between 50 and 55 volts; it was a half-wave rectifier, the valve in use being of the U.4 Marconi type. The results with our set were very good, but full volume was not obtained owing to the fact that it takes about 22 milliamperes at 120 volts. No hum was perceptible, except when the set was on the verge of oscillation. The range of the set was only very slightly inferior to that usual when "super" dry batteries were employed. The absence of means of regulation of the detector voltage was rather a disadvantage. (This has been rectified in a later model.)

Eliminator No. 2.—The second instrument tested was manufactured by a Sheffield firm, and priced at about £7. It appeared to be a two-valve full-wave (or bi-phase, as the term seems to be) rectifier. It had five positive terminals, and the voltage of each increased as the rheostat was turned towards the "on" position. The maximum output could not be accurately measured when the particular instrument was on test, but there was not enough to give full volume to the cone-type speaker usually used. The demand on the a.c. side was 25 watts, and there was no hum, but when also tested on a resistance-capacity coupled set the hum was very bad. (It has since been found that this feature is common to most eliminators, but the trouble can usually be obviated by replacing the grid leaks of the coupling condensers in the set by audio-frequency chokes). In passing, radio valve makers deprecate voltage regulation by decreasing the voltage of the rectifier-valve filament. It is claimed that this increases the impedance, causing heating of the anode, and consequent decrease of valve life owing to release of occluded gases.

Eliminator No. 3.—A large advertisement in the pages of the REVIEW directed our attention to a different type of instrument, which does not employ thermionic valves, but a special gas-discharge tube. Arrangements were made to try one of this type: it is housed in a metal case (which may be earthed if desired) and has a fully variable detector tap of about 7 to 60 volts, or slightly more. The amplifier voltage is given as 135 V, and the maximum output *at this voltage* is given as 25 mA. A neon tube functions as a voltage regulator, and if more than 25 milliamperes be taken, it will cease to glow, and the voltage will drop to about 100 at 30 mA. On the a.c. side the consumption is 8 watts, as near as could be measured; there was no hum whatever, and the range of the set seemed to be as good as usual.

The disadvantage of this instrument is its high price (£10 15s.), but this is probably set off by cheaper running costs and absence of valve replacements. The tube, of course, will last as long as the vacuum in it, and, provided that care in the selection of the glass is taken, this could be several years. Unfortunately, the price would not permit of our purchasing this one, otherwise we would certainly have bought it at once; in fact, in a year or so's time, we may still do so. By the way, "bi-phase" rectification is used in this case.

Eliminator No. 4 was made by a Manchester firm, and had two thermionic valves of the DU.5 type arranged for two-wave rectification. The price was about £8, and taps were provided at 60 volts, 150 volts, and a variable one in 20-volt steps, from 20 to 150 volts. A number of grid-bias taps were also provided, but were not used. The output (maximum) at 150 volts was of the order of 25 mA, and the input current about 20 watts. The instrument gave very good results on the whole, though a faint ripple could be heard superposed on the higher notes of a soprano, or those of a wind instrument; it was not objectionable and could only be detected with difficulty. This firm has since introduced a new model, with voltages as above, but a claimed output of 70 mA. The price also has been reduced to £6 15s. (See footnote.)

Postponement.—After a trial over a day or two, we decided not to do anything definite about this model. There were rumours of something better still (the later model mentioned) and, meanwhile, a set of high-voltage accumulators was returned to the dealer by the purchaser of such an instrument. The opportunity seemed too good to be missed; the price was right, and the condition good, so a bargain was made on the spot. The problem of charging was overcome by installing two DU.5 valves in parallel, filaments heated by means of an ordinary bell transformer, and a two-throw switch with four poles to connect the battery to the charger and close the mains circuit, or to the set, as

desired. This charges at 30 milliamperes, and when the set is disconnected for the night, the charger comes into operation until the set is required again. (The set is used about 36 hours per week on the average, and dry batteries were found somewhat costly.)

Conclusions.—However, these notes are primarily on the "eliminator," and we may sum up by saying that almost any of the better-class instruments will give satisfaction on the average set, taking between 10 and 20 milliamperes; for a smaller output, "super" dry batteries are satisfactory; if larger, high-voltage accumulators are desirable.

The note on resistance-capacity coupled sets (above) has been borne out since by experience; if the set is of a "supersonic" type, only a test can tell whether a battery eliminator will be satisfactory. We are fully aware that many other types are available, apart from those described above, but we have only mentioned those personally tested; the number was restricted by the attitude of the average radio dealer, who expects one to purchase an instrument costing upwards of £5, without reference to whether it will, or will not, work under certain conditions—or even at all, in a very few cases.

Kits of parts for home construction are available in some cases, usually priced somewhere about £2 less than the complete instrument. It is questionable whether home construction is worth the saving; it is much easier to persuade the manufacturer to "service" the complete thing in case of any trouble, than the parts, however carefully assembled. We have by no means exhausted our trials, but have had to postpone them for a few months; meanwhile, perhaps the results of our inquiries will interest readers who also saw the notes on the power supply for radio receivers. So far, our ideal is No. 3, though the price may take some little scraping together; we are also going to test the improved model of No. 4, as soon as the dealer can obtain one. The promised output of 70 mA seems very desirable, for it will mean that a valve of the "super-power" type can be operated with a minimum of expenditure.

The new indirectly-heated cathode valves also show a large degree of attractiveness. We seem to be approaching the day when a radio set having a choice of, say, two programmes will be built to run entirely from the mains; a single three-position switch, giving A, B and "off," the only control necessary. The only thing we lack at present is the alternative programmes!

NOTE.—Since writing the above notes, we have had an opportunity of testing one of the improved type mentioned above, by the Manchester firm. It is now priced at £6 15s. (valves extra), the same voltage arrangements are made as on the older model. The maximum output is 70 milliamperes, and full-wave rectification is used; the input on the a.c. side is approximately 18 watts. This instrument is much better than the older model; there is no trace of hum when a pair of headphones is connected to the 4-valve receiver used, even when the set is oscillating.

The moderate price and large output have persuaded us to place an order for one of this type. The valves are priced at 15s. each, and should last 1,500 hours. Since we pay about 0.8d. per kWh for our energy (on the inclusive domestic rate), the running cost for the 36 hours per week on the average during which the set is in use will not be heavy, perhaps 2s. 6d. per year. The valves should last a year, giving a total maintenance cost of 32s. 6d. per annum in this case. Add to this the interest on £6 15s., and the grand total (at 5 per cent.) comes to 39s. 3d., which will certainly be cheaper than "super" dry batteries, three per year of 120 volts, at £2 2s. 6d. each, total £6 7s. 6d.

In certain cases a royalty of 12s. 6d. is payable on eliminators.

The Shops Hours Bill.

Important Alterations Proposed.

By W. ERIC JACKSON, LL.B., Barrister-at-Law.

IT has long been felt that some revision of the Shops Hours Acts is desirable. At present the majority of shops are regulated by three Acts, and in every case two of these at least apply. Now a further Act is foreshadowed by the introduction of the Shops Hours Bill in the House of Commons.

It may be felt in some quarters that it is rather a pity that the Legislature has not seen fit to cancel all the existing statutes dealing with shops and co-ordinate the law in one comprehensive Act. The Bill does not propose such drastic revision. All that is suggested by it is a limitation of hours of work, regulation of the payment of overtime, and amendment of certain important definitions.

The main purpose of the Shops Acts is not so much to enforce early closing as to ensure reasonable working hours for employés. The present Acts do this by providing that every employé shall have his weekly half-holiday, and by providing that shops shall shut at regulated hours; but, except in the case of young persons under 18, no provision is made as to the hours of daily work. Hence at present a shop assistant may work 14 hours on five days a week and be within the law so long as on the sixth day he ceases work at 1.30 p.m. The provision that shops shall shut at 7 p.m. may be some safeguard to assistants so long as the shop opens at a reasonable hour, but the law has not dealt with early opening. Hence a tobacconist has been held to be quite within his rights in closing at 8 p.m. and opening again at five minutes past midnight. The same applies to shops selling electrical goods.

The new Bill, in Section 1, goes to the root of the whole matter. Henceforth no assistant is to work more than 48 hours a week, exclusive of meals. This provision will probably be much criticised in many quarters. It means that assistants may work from 9 a.m. until 7 p.m. on five days a week and from 9 till 12 on Saturday (or Wednesday). The extension hour on Friday will be impossible unless assistants are given time for tea on each day of the week. The present law contains no such regulation as to hours, except in the case of "young persons," who at present must not work more than 74 hours a week, including meal times. If the Bill passes, young persons and adults will all be on the same 48-hour footing. The shop-keeper must produce a list showing the hours per day for each assistant, and keep the list in a conspicuous place in the shop. A further provision is that if any assistant works partly in the shop and partly in a factory or workshop, the total number of hours worked altogether must not exceed the limit of hours laid down in the Factory and Workshop Act.

As regards overtime, the Bill states that for the first half-hour payment is to be made at ordinary rates, for a further period beyond this, time and a half is

to be paid; and on Sundays and public holidays double time. Overtime is to be reckoned in half hours, any period less than half an hour being reckoned as half an hour. The Bill therefore recognises the need for overtime, but criticism will doubtless be levelled at the suggestion for reckoning 10 or 15 minutes' overtime as half an hour.

The interesting part of the Bill, from the legal standpoint, is the amendment of the definitions of "shop" and "shop assistant." A shop means any premises, or any part of any premises, where any *wholesale* or retail trade is carried on, or which is used in connection with the carrying on of wholesale or retail trade, but not a factory or workshop. It appears, then, that any premises where things are bought and sold is a shop for the purposes of the Bill. The inclusion of wholesale premises is an innovation which will probably make little difference in most cases to the hours, but it will impose on wholesalers the duty of rearranging their staff to fit in with the Bill where necessary, and in every case the list of hours mentioned above will have to be made out and displayed. The definition is very wide and will, of course, include a dispatch and packing department, and very possibly the office. This is borne out by the definition of "shop assistant" who, in the Bill, is described as any person wholly or mainly employed in connection with any shop for the serving of customers or receipt of orders or collection, dispatch, and delivery of goods, or in any clerical capacity. Accordingly, clerks, accountants, carmen, messengers, and very probably commercial travellers are shop assistants, as well as counter hands, for they are all employed in connection with a "shop" in one or other of the capacities above mentioned.

Substantially these are the effects of the proposed amendments. The Bill still leaves untouched the somewhat complicated position of a shop in which two trades are carried on. Closing orders will continue to be made by the local authorities, regulating the hours of closing for different classes of shops. Difficulty has often been felt in the case of a shop which sells articles applicable to more than one trade. Electrical dealers sell lighting equipment, radio apparatus, and motoring accessories. Are they to close on the day appointed for hardware, for musical supplies, or for ironmongery? In cases where a shop has two departments, an electrical side and, for example, a furnishing side, the shop must shut on the electrical side on the day for such shops, but need not shut on the furnishing side if such shops are given a different day. Where an article is common to two trades, it may be sold by exempted trades at all hours, but non-exempted trades may not sell it after hours. Take, for instance, acid for accumulators. Sold by an ironmonger after hours, it would be a breach of the law; sold by a chemist when ironmongers were shut, but during the extended hours for chemists, it would be quite legal; sold by a motor dealer at any hour it would be legal. The question is not so much whether an article is hardware, musical supplies, or motor accessories. A trader must not trade at all beyond the hours laid down for that particular class of shop. There may seem some inequality in this, and the inequality may become even more apparent when wholesale houses are brought within the Shops Acts; but such is the law, and the only remedies are either to prevent the proposed amendments and to seek an alteration of the existing Acts, or to have each business put into several classes by carrying on in each shop several distinct trades so that articles common to all those trades may be sold at all hours.

Cheaper Wiring.

The Petty Objections of Urban and Rural District Council Authorities.

By H. W. C.

IN spite of the I.E.E. Rules, &c., no definitely recognised standard exists which can be used to settle any disagreement which may arise between the supply authority and the contractor. The former is all-powerful, and can in many cases make things decidedly unpleasant for a contractor who offends it. If it is not convenient to supply, say, a heating load in a particular spot, the slightest excuse will be used as an objection. The policy of cheap wiring is subject to different views in many quarters, and woe betide a strange contractor who does not comply with the letter of the I.E.E. Rules or the pet theories of the supply company's district engineer! I came across one who required wiring to be rated on the 1,000-amp. per sq. in. rule for a load of 10 amperes! Tactful nursing of the supply engineer's complaint brought about the waiving of this point, and wiring at the I.E.E. ratings for small cable was then accepted as satisfactory.

It is considered in many quarters that the I.E.E. Rules are far too stringent, and form a hindrance to popular electrical development. One such instance is the separate fusing of each heating point installed for the use of radiators. In many suburban dwelling-houses one 2-kW portable radiator with plugs in five of the rooms serves a very useful purpose. Where this equipment answers all the requirements, the cost of a 50-amp. main switch, 50-amp. mains from switch to fuseboard, and five separate circuits of, say, 7/22 s.w.g. cable, would be out of proportion to that of the apparatus installed.

Some contractors have overcome the difficulty by the use of a central plug and very long lengths of flex. But flexible cable at best is not very desirable, and I consider that a looped-in system can in many cases serve the purpose well, without involving undue risk. I once came across a small urban district council which required such an installation to be carried out in accordance with the strict letter of the law, and refused to connect up to any looped-in system, but yet fitted a 10-ampere meter to the circuit, which, it demanded, should consist of cable not smaller than 7/16 s.w.g. I have often wondered how much business is lost through such stringent rulings.

In spite of the campaign for the development of electricity, I strongly believe that many small concerns, for reasons best known to themselves, will not be bothered with heating and cooking loads. In several places the tariffs are by no means encouraging, and this seems to indicate that my suspicion is well founded. The retailers and distributors of electricity can undo many of the most ambitious schemes of the Electrical Development Association.

Before a contractor of repute can quote with certainty or compete with others in a strange area, he

has to make himself acquainted with the whims of the local supply authority. There is no compulsion for any supply authority to accept even the I.E.E. installation rules, and the many devices that are brought out to aid economy are being defeated by conservative opposition.

The minds of such authorities are often undecided as to the use of switches at plug points. Unless plug and switch are interlocked, the purpose of the switch alongside a plug point is often defeated. Where apparatus is provided with switches to control all elements, the cost of a switch, if it is not going to be double pole, may as well be saved. This is especially true of circuits not exceeding 10 A capacity at 240 V a.c. Here the arc consequent on breaking full current at the plug points is not severe, and it is a rare occurrence for a short circuit to result between the poles.

To stabilise business and to make the procedure a definite matter for the contractor, a set of regulations should be printed and made available on demand, by each authority, or a set of minimum requirements should be drawn up, which would be capable of universal application. These would represent the average practice of all parts of the country, and all should be compelled by legislation to observe them as final. The I.E.E. Rules are not sufficiently flexible to cover all the different types of installations of one class. The wide difference of opinion and storm of protest that the last issue of rules provoked are surely indicative of the need of adjustment. The stringency of these rules has brought about a very natural result: average practice in the class dealt with shows a surprising lack of uniformity, and the regulations are honoured more in the breach than the observance.

The procedure for obtaining the connection of supply, or the extension of installations, is by no means uniform, though here it must be said that each authority states more or less definitely what it requires.

The allocation of service costs has often decided the question of a proposed installation to the disadvantage of the supply company.

The description of the usual standing charge as "meter rental" is somewhat of a misnomer, and its interpretation is a matter for tactful decision when dealing with the individual parties concerned.

Delays in meeting new demands are often a cause of dissatisfaction. These few points, together with those mentioned by other authors, show very forcibly the need for some control over the conservative, and in many instances exasperating, quibbles of petty urban and rural electricity authorities.

The relative reliability of underground cables and overhead lines has recently been considered with direct reference to continuity of service. Stoppages of supply are inevitable, but the number of stoppages per annum in some cases is far from reasonable. The reliability of service is often a matter of bad or good organisation, and the majority of private companies in this connection show a marked difference in the management of their undertakings and in courtesy towards their consumers.

A Russian Electrical Manufacturing Concession.

Agreement with a Swedish Company.

IT was mentioned in this journal some time ago that negotiations were proceeding between the Allmänna Svenska Elektriska Aktiebolaget and the Soviet authorities with a view to the former embarking upon the construction of electrical machinery, &c., in Russia. It is stated by Director Edström, of Vasteras, that the company during the war started the erection of manufacturing works at Yaroslaff, but the work naturally stopped on the outbreak of the revolution. It is now intended, among other matters, to put this particular works into operation, apart from the contracts which have been carried out in Sweden and those which still remain to be executed for Russian account.

The negotiations have been conducted for Swedish interests by Mr. E. Lindgren, who now becomes the principal of the Russian works, and the concession was signed by the Soviet Concessions Commission in Moscow on May 25th in the presence, it is said, of the Swedish Minister in that city. Under the concession, the A.S.E.A. is granted the right to construct, equip and work in the town of Yaroslaff an electrical engineering works for the construction of alternating-current machines of a size of from ¼ to 700 h.p., the concession being for a period of 35 years.

According to the details published in the official organ of the Council of Labour and Defence of May 26th, the company is placed under the obligation to begin the construction and equipment of the works within a period of three months in order that their productive capacity may be 2,000 tons in the year 1929-30 and 4,000 tons in the following year. The importation of the necessary equipment for the works, free of import duties, will be permitted for a period of four years, and the right is also granted to import basic and raw materials necessary for production, on the payment of import duties and licence fees, but only on condition that such products cannot be furnished within the limits of Russia.

The agreement provides for the importation by the company of some electrotechnical articles from abroad and their sale within the country. However, this right of sale is restricted to State and co-operative organisations and share companies in which State capital is interested. The profits resulting from such sales are not to be sent out of the country, but must be invested in the concession undertaking. In return for the grant of the concession, the company will pay to the Government a share in the value of the products sold in accordance with a scale provided for in the agreement, but the amount of this is not specified in the Moscow newspaper. In the event of the net profits of the undertaking exceeding this scale, the agreement provides that a supplementary share shall be paid to the Government. All taxes and imposts will be paid by the concessionnaire company on the same level as in the case of State undertakings which are conducted on a commercial basis.

On the expiration of the concession all the undertakings, in good condition and in accordance with the productive capacity which was reached during the last two years, will pass free of charge and clear of debt into the possession of the Government, which will only pay to the concessionnaire the unredeemed part of the expenditure incurred by the company in the last

five years, subject to the proviso that such outlay has been carried out in agreement with the Government.

Apart from the preceding information from an official Russian source, it may be noted that, according to a statement ascribed to Mr. Edström, the agreement also contains a clause that the company has the right of employing Swedish workmen and has a free hand in this matter.

Since the preceding notes were written some further information has become available as a result of the return from Moscow to Sweden of Mr. A. Linden, deputy managing director of the A.S.E.A., who is reported to have stated that it is the works which the company started in Yaroslaff in 1916 which is now to be completed. This works was never nationalised and the company all the time has maintained connections with Russia through its office in Leningrad and consequently has a good knowledge of the economic development in the Soviet Union. According to the agreement, the company will turn out exclusively standard motors for alternating current of sizes up to 700 h.p., and the capacity of the works will be about 30,000 motors per annum of an average size of 10 to 12 h.p. Mr. Linden is further reported to have stated that special engineers, foremen and workmen will be transferred from Sweden to the Russian works. The profits of the undertaking up to 25 per cent. per annum will be retained by the A.S.E.A., while out of the surplus over this amount a part will pass to the Russian Government according to a fixed scale; and the company will have the right to transfer the profits abroad. (This, however, does not agree with the Russian version, as given above.) In order to carry out the scheme Mr Linden states that it is intended to form a special Swedish company with a share capital of Kr. 10,000,000 to which the concession and the works will be transferred. Besides having the right to import into Russia a certain quantity of semi-finished products, the company is authorised to import manufactures made at the company's works in Sweden to be sold at current prices, and as a result of the agreement the company will now be able to take advantage of its former investments in Russia, which are unofficially stated to amount to Kr. 10,000,000.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

Wages in the Electrical Contracting Industry.

The National Federated Electrical Association informs us that the variation in the cost of living since the last announcement justifies a reduction of 27½ per cent. in the basic rates of wages in the electrical contracting industry. The new rates, which will come into effect on the second pay day in June, and will remain in force up to and including the period covered by the first pay day in October, are as follows, the existing rates being shown in parentheses:—Grade A, 1s. 9¾d. (1s. 10¾d.); Grade B, 1s. 7¼d. (1s. 8¼d.); Grade C, 1s. 6¼d. (1s. 7d.); and Grade D, 1s. 4¾d. (1s. 5¾d.). Mates' wages are at the rate of 80 per cent. of the journeymen's rates.

Wages in the Engineering Industry.

In pursuance of the instructions of the National Committee of the Amalgamated Engineering Union to continue negotiations for increased wages with the Engineering Employers' Federation, the Executive of the union has asked for a further conference with the employers. This has been agreed to, and will be held on June 14th. It is the intention of the A.E.U. to submit any offer which may be made to a ballot of its members.

Recent Contracts.

JACKSON BOILERS, LTD., Leeds and Westminster, have recently received many important orders for electrically-heated boilers. Among these is an installation at the Carlton Theatre, Haymarket, S.W.1. Fitted in the servery attached to the stalls bar is a "Jackson" boiler fitted with coffee-making machine and milk container. During the evening performances at the theatre this installation is used principally to provide coffee and hot milk, but during the matinées it is also required to supply boiling water for tea-making. The machine is self-feeding direct from the cold water main, whilst the current is automatically switched on or off according to the demands on the apparatus. In the balcony bar there is a "Jackson" café fountain boiler, automatically controlled as described above, which is used to supply the boiling water for matinée teas.

In connection with the recently-inaugurated electric lighting scheme at Tobermory, Island of Mull, the HART ACCUMULATOR CO., LTD., supplied a battery of 122 11-plate cells.

There has been delivered at the power station of the Glasgow District subway railway, operated by the Corporation Tramway Department, the second of two steel cables, each nearly seven miles in length, 56 tons in weight, and nearly 1¼ in. in diameter. The first cable which was delivered a month ago, was manufactured by MESSRS. J. & E. WRIGHT, LTD., Birmingham, and the second by MESSRS. R. S. NEWALL & SON, LTD., Liverpool. The cables replace those at present used for hauling the subway trams and have no joint or splice all through their respective lengths.

Municipalities and Foreign Cables.

At a recent meeting of the Coventry Town Council a report was presented by the Electricity Committee recommending that the Council should rescind its decision that the lowest British tender for cables should be accepted, and that the Committee should be allowed to purchase low-pressure cable in "the open market." After some discussion a resolution giving the recommendations effect was carried by a large majority. During the discussion it was pointed out that a "fair wages" clause was inserted in all contracts with British firms, while the payment of fair wages by foreign manufacturers could not be assured. For the Electricity Committee it was stated that it considered its patriotism was being traded upon.

The subject of foreign cables was raised at the meeting of the Doncaster Town Council last week, when the Electricity Committee reported the acceptance of a tender for Dutch cables put in by Messrs. Hogan & Wardrop. The price (£2,621) was said to be £822 less than the lowest British tender. The chairman of the Committee (Ald. E. Dowson) said that three years ago tenders for about £1,500 worth of British cable exhibited differences of as much as £200, but now the offers were all practically the same. The Committee was willing to deal with British manufacturers if they quoted reasonable prices. Ald. Dowson also said that the Dutch company concerned conformed to trade union rates of wages and hours and was thus on a level with British firms.

A Notice to Travellers.

Travellers calling on Messrs. J. A. Crabtree & Co., Ltd., the well-known firm of Walsall electric switch manufacturers, are advised to be honest in their own interests. Outside the inquiry office of the company there appears the following notice: "We find that many representatives (and particularly those introducing new lines) refuse to state their business, claiming that they wish to see the principals on important private business. In future, principals will terminate immediately ordinary business interviews obtained under such false pretexts and representatives are warned that any possibility of future business will be seriously prejudiced by their action."

The Enforcement of Wage Agreements.

At the annual meeting, on June 2nd, of the Association of Joint Industrial Councils and Interim Reconstruction Committees, it was reported that the Minister of Labour had written to all Industrial Councils asking them for their considered opinions of the proposal to give legal force in the whole of the industry concerned to wage agreements arrived at by the Councils.

Social Events.

A golf match between Edinburgh electrical men (the "Jocks") and Newcastle electrical men (the "Geordies") took place at Goswick Golf Course, Northumberland, on May 30th, 1927. Mr. Walter Finlay brought ten players from Edinburgh, and a party of eighteen went up from Newcastle. Ten games were played, the "Geordies" winning by six games to three, with one game halved.

The eighth annual sports meeting of the London establishments of the General Electric Co., Ltd., is being held to-morrow (Saturday) at the G.E.C. Sports Ground, Wembley.

On the following Saturday (June 18th), the Hackbridge Electric Construction Co., Ltd., is holding its third annual athletic meeting at the works ground, Hersham, Walton-on-Thames.

The French Electrical Industry.

M. Zetter, delegate of the General Syndicate of Electrical Construction, has communicated to the *Journée Industrielle* the results of the inquiry which he has made into the position of the different groups belonging to the Syndicate. The Syndicate of Electrical Machine Manufacturers reports that the reduction in business is from 20 to 40 per cent. Unemployment is small, but working hours have been reduced by from five to ten hours a week. The Syndicate of Manufacturers of Electric Accumulators, Batteries and Carbons announces that in this branch of industry the tonnage of orders has not decreased very much. On the other hand, the margin of profits has been considerably lessened, and the Syndicate attributes this to insufficient Customs protection for these manufactures. The Syndicate of Manufactures of Insulators for Electricity, &c., says that the crisis that followed the revalorisation of the franc has resulted in a 20 per cent. decrease in production and sales, as compared with August and September last year. The number of workers has been reduced in a similar proportion. It may be said, however, that present conditions approximate those of last year.

The Chamber of Constructors of Meters, &c., says that this industry has experienced a decline in business without precedent during the past few months and business is still below normal. Better business was done during the first six months of 1926, and several manufacturers were able to spread deliveries over a long period, keeping unemployment low; it still amounts, however, to about 10 per cent. The lamp industry reports decreased sales, mainly due to the fact that stocks have not been replenished in expectation of a decrease in prices. The Chamber of the Iron and Steel and Associated Industries of the Department of the Rhone and Region (Electricity Group) reports that there had been a rather large decrease in orders and price inquiries up to January 15th. Since March 15th, however, there has been a slight revival at most establishments.—*Reuter's Trade Service* (Paris).

The British Export Society.

British Industries states that Col. the Hon. F. Vernon Willey presided at the annual luncheon of this Society on May 18th. In welcoming the gathering, which consisted largely of those engaged in the export trade, Col. Willey referred to the objects of the Society which are, briefly, "to secure the more efficient marketing of British goods overseas by encouraging practical co-operation between exporters and by acting as a clearing house for the mutual exchange of ideas, information and experiences." He said he was encouraged to see what a large proportion of the younger men were members of the Society. There was a great field for its activities and energies, for he was convinced that our industrial problem had ceased to be one of production, and had become one of distribution.

An Important Indian Contract.

A £300,000 order in connection with the main-line electrification of the Great Indian Peninsula Railway (Indian State Railways) has been placed with Messrs. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD. It comprises the supply and erection of 269 miles of overhead line on lattice steel towers. The conductors, of steel-cored aluminium, are for a working pressure of 110,000 V. Two parallel double-circuit lines will be run from Kalyan power station to Kalyan, a distance of 2½ miles. From there, two parallel single-circuit lines, one on each side of the railway track, will be run in a northerly direction to Igatpuri, 50 miles away, and two parallel single-circuit lines in a southerly direction to Kirkee, 82 miles away. These lines will supply electricity to the railway from Igatpuri to Poona.

"Amplion" on the Continent.

GRAHAM AMPLION, LTD., has sent us a list of Continental events for which the "Amplion" public speech and band repeater equipment has been or is being installed. Among these is an important tennis event at Knocke, Belgium.

Merchandise Marks Applications.

The Board of Trade has referred to the Standing Committee (General Merchandise) applications for Orders in Council to be made requiring indications of origin in the case of, *inter alia*, electric lamp-holders, wall plugs, switches, and similar household fittings and metal parts thereof. Representatives of any interests substantially affected by any of these applications who desire to be heard in opposition should communicate with the secretary to the Committee, Mr. E. W. Reardon, New Public Offices, Great George Street, S.W.1, not later than June 24th.

Unemployment.

The reduction of the number of registered unemployed to 978,200 during the week ended May 23rd brought the total to the lowest level since 1920. The decrease during the week was 28,820. The total upon the corresponding date of last year was 1,597,679, but this was just after the general strike, and the coal dispute was in progress.

Trade Discount Abuse.

The Medical Supply Association, Ltd., of Gray's Inn Road, W.C.1, informs us that it having come to its notice that a municipal electricity supply undertaking in the provinces had been abusing the wholesale discounts given to the trade by passing the benefit of such discounts on to the retail consumer, it recently wrote to the engineer objecting to this abuse. The company wished it to be distinctly understood that the trade discount was intended for the benefit of the trader, and that it was a breach of trading conditions for it to be passed on.

A Polish Offer.

The *Chamber of Commerce Journal* states that the Polish weekly journal *Przemysl i Handel* offers to insert free of charge, under the heading of "Trade Opportunities," inquiries from British firms as to trade activities in Poland, such as offers of goods, demands for goods, agencies, &c. Those interested should address such items to the Editor of the *Przemysl i Handel*, c/o the Polish Ministry of Industry and Commerce, Warsaw.

Irish Free State Electrical Imports.

The Irish Free State Ministry of Industry and Commerce has now issued detailed figures of imports for the whole of the past year, comparing them with 1925. From these we have compiled the appended table showing the value of the total imports of electrical machinery and apparatus into the Free State and the amount attributed to the United Kingdom as country of shipment, but not necessarily of manufacture:—

			U.K. Share.	
	1926.	1925.	1926.	1925.
	£	£	£	£
Electric wires and cables	115,545	123,620	62,848	92,367
Telegraph and telephone instruments and apparatus ...	40,430	28,691	35,788	27,909
Electric lamps and parts	56,995	58,917	52,645	56,878
Batteries and accumulators	39,014	36,418	34,575	34,048
Radio sets and parts	90,211	84,966	86,065	83,125
Other electrical goods and apparatus ...	108,054	70,703	75,462	67,455
Generators	28,953	18,042	11,665	13,822
Motors	37,822	23,465	21,090	22,811
Other electrical machinery	85,740	73,873	72,966	63,261
Totals ...	£602,764	£518,895	£453,124	£461,676

It will be seen that, with the exception of electric lamps, and electric wires and cables, the importation of all classes of goods showed a marked advance over 1925, the total representing an increase of £83,869. Of the imports £453,124, or approximately 75 per cent., came from ports of the United Kingdom, leaving £149,640 for foreign countries. Of this balance the bulk (£138,933) is credited to Germany, £4,430 to Belgium, and £11,277 to "other countries."

A French Electrical Exhibition.

Under the auspices of the Association Française pour le Developpement des Travaux Publiques and the electrical section of the Association Amicale des Anciens Elèves de l'Ecole Centrale of Paris, the fourth exhibition of electricity and its applications is to be held in that city in July next. The exhibition, of which particulars can be obtained at the Association Française, 60, Rue de Londres, Paris, will include sections for electro-chemistry, electro-metallurgy, electrolysis, &c.

A Russian Order Canard.

At a meeting of the Preston Town Council on May 16th, the bulk of unemployment in the town was attributed to the shortage of orders at the English Electric Co.'s works, and it was stated that by the abrogation of the trading agreement with Russia the company would lose an order over £2,000,000 in value. The English Electric Co., Ltd., assures us that it has no knowledge of any such order.

Local Exhibition.

EASTBOURNE.—The Corporation Electricity Committee has decided to hold an electrical exhibition in the Manor House grounds during the period of the forthcoming flower show.

"Putting Price in its Place."

An address bearing this title was delivered by Mr. A. F. Waller, managing director of the National Electrical Manufacturers' Association (U.S.A.), at the recent annual meeting of the Association. After illustrations of the fact that price is not the only consideration, taken from such widely-separated directions as lamp equipment and insurance, he proceeded to adapt his deductions to the electrical industry, stating that "the system described, with variations to suit, may be used in connection with buying or selling almost any kind of apparatus imaginable. I have applied it to the purchase of sand-blasting machinery, electric furnaces, electric motors, bank stock, and automobiles. It puts price in its place simply because it makes price one of a number of essential points entering into a definite transaction. When the high and low extremes in competitive bids have been established, the interest immediately centres upon the spread in price. What features exist to justify the difference? It is desirable to consider this difference not only in dollars, but in per cent. . . . On the question of the purchase or sale of material, anyone can do it who will first find out what are the essential points, and then take the trouble to get exact information in regard to them. Every salesman or sales engineer who has to sell goods in a competitive market should personally and individually compile information of this kind regarding certain key sizes of the line he handles, comparing them with the competition he has to meet. Such a study serves several purposes, among which are:—1. Informing himself as to the actual work he has in hand. 2. Selling his product to himself on an 'index' basis. 3. Development of a realisation that price in its place is only one necessary item relating to a transaction, and not the predominating feature."

Unemployment in Germany.

The Berlin correspondent of *The Times* says that the number of persons in receipt of unemployment relief in Germany on May 15th was 972,000, as compared with 1,217,000 on April 15th, a decrease of 20 per cent.

The Swedish Ericsson Company.

The report of the Telefon Aktiebolag L.M. Ericsson states that 1926 was characterised by favourable activity. The stock of orders increased from a value of 14.9 million kronen in 1925 to 19.3 millions last year, while the deliveries rose from 15.7 millions to 19.1 millions in the two years respectively, and the number of persons employed from 2,288 to 2,834. As a result of the extent of the orders, the services of the company's foreign works were utilised in a greater measure for the completion from Stockholm of deliveries to foreign customers. The foreign subsidiary and sale companies showed progress with the exception of the French works and the Polish sales company, which had to contend with specially keen competition on the part of foreign makers. The report states that the French company was unable to compete with other French works. As a consequence an agreement was made at the beginning of 1927 with one of the largest French electricity companies, which has entered as a shareholder in the Société des Téléphones Ericsson, and in connection with this step the share capital of the French company has been doubled.

Book Notices.

"Touring by Motor Coach" (100 pp. and map), Lancashire United Transport & Power Co., Ltd., price 6d.—This annual publication is an indication of the advent of summer; it contains copious notes and illustrations of beauty spots within the wide area covered by the company's services.

"Technologic Papers of the U.S.A. Bureau of Standards." Vol. 21, No. 335, "Thermal Expansion of Graphite" (5 cents).

"Electric Wiring Diagrams for Motor Vehicles." By M. A. Codd. Third Edition. Pp. iv + 241; figs. 241. London: E. & F. N. Spon, Ltd. Price, 4s. 6d. net.

"Alternating Current and Electrical Engineering," by P. Kemp. Third edition. Pp. xi+575; figs. 423. London: Macmillan & Co., Ltd. Price 15s.

Scientific Papers of the U.S.A. Bureau of Standards.—Vol. 21, No. 546, "Magnetic Reluctivity Relationship." Vol. 22, No. 547, "A Spectrophotometric Analysis of the Lovibond Glasses."

"Magneto Manual," by H. R. Langman. Pp. x + 221; figs. 85. Price 7s. 6d. net. "Domestic Electric Heating," by H. G. Solomon. Pp. vii+116; figs. 50. Price 3s. 6d. net. "Modern Ignition," by H. H. U. Cross. Pp. 144; figs. 58. Price 4s. net. London: Crosby Lockwood & Son.

A new edition (two volumes) of "Steam and Gas Turbines," by A. Stodola and L. C. Lœwenstein, is announced by the McGraw-Hill Publishing Co., Ltd., London, to appear on July 1st. The price as from that date is £3 15s. net, but for all orders placed before July 1st it will be £3.

"Dielectric Phenomena," by S. Whitehead. Pp. 176+42 diagrams. London: Ernest Benn, Ltd. Price 12s. 6d. net.

Fires.

The Times reports that the works of the Whitfield Electrical Company, Ltd., Park Street, Barnet, were destroyed by fire on June 2nd.

Fire broke out at the works of the Mirrlees Watson Co., Ltd., Glasgow, on June 5th. The outbreak originated in an open yard which was stacked with valuable patterns, and spread to four separate buildings, including a large joiners' shop The firemen prevented the flames from reaching the power station of the Corporation underground railway. No casualties are reported. The damage is estimated at £20,000.

New Swiss Company.

The Emerit Gesellschaft is the name of a new concern which has been formed at Birmensdorf, Zurich, to manufacture electrical insulating material under the patents of Herr Max Haefeli, of Basle.

Patent Application.

Application has been made for the restoration of Patent No. 193,604 of 1922, granted to F. C. Raphael, for "Improvements in electric fittings and means for fixing same.

Trade Announcements.

The London sales organisation of NEWTONS' DYNAMO WORKS will, from July 1st, be removed from 219, Tottenham Court Road, W.1, the address of Messrs. Baxter & Caunter, Ltd., to 224, Shaftesbury Avenue, W.C.2, which is the office of the firm's associated company, Messrs. Joseph Lucas, Ltd. Mr. S. G. Mundy, formerly with Messrs. Baxter & Caunter, will be in charge of the organisation. The telephone number of the new address will be: Regent 8033 (three lines).

METRO-VICK SUPPLIES, LTD., 155, Charing Cross Road, W.C.2, announces that no deliveries of material will be made from the afternoon of June 17th until June 20th inclusive, as its London offices, stores, trade counter and showroom will be closed for annual stocktaking.

Messrs. J. MACGREGOR & Co. state that they have registered the name "Usym" No. 480,113 (Class 13) for the lamps supplied by them.

MESSRS. FREDERICK THOMAS & Co., Hampstead, N.W.1, have opened at 9, Charlotte Square, Newcastle-on-Tyne, a trade showroom, where a large range of their electrical fittings are displayed.

Catalogues and Lists.

MESSRS. WINGROVE & ROGERS, LTD. (British Electrical Vehicles), 63, Queen Victoria Street, E.C.4.—An illustrated folder depicting "B.E.V." electric locomotives and trucks in use in various parts of Australia.

The JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, S.W.1.—June calendar-blotter, illustrating and describing the "No. 154" electric wash-boiler.

MESSRS. HUGH J. SCOTT (BELFAST), LTD., Ravenhill Avenue, Belfast.—Stock lists of a.c. motors and d.c. motors and generators. Priced.

MESSRS. MAVOR & COULSON, LTD., 47, Broad Street, Mile End, Glasgow.—June calendar-blotter advertising the "M. & C." gate-end loader for electrical or pneumatic power.

THE VARIABLE SPEED GEAR, LTD., 6, Broadway, S.W.1.—An illustrated brochure describing a variable delivery pump of improved design.

MESSRS. HERBERT MORRIS, LTD., Loughborough.—Book 33, containing illustrated particulars and prices of the company's goods-handling equipment.

BROOK MOTORS, LTD., Empress Works, Huddersfield.—Booklet No. 158, giving particulars and prices of "Brook" motors for mine use.

MESSRS. SIEMENS BROS. & Co., LTD., Woolwich, S.E.18.—Pamphlet 550A, describing some of the special features of the mounting arrangements used for selectors and relay sets in the automatic telephone equipment for London exchanges.

HOPKINSON INDUCTION MOTORS, Willesden Lane, North Acton, W.3.—June stock list of squirrel-cage and slip-ring motors.

MESSRS. WHEELER & SONS (ENGINEERING), LTD., St. Stephen's House, Westminster, S.W.1.—A pamphlet describing the company's "Eleconomic" radiators. Illustrated and priced.

PHILIPS LAMPS, LTD., 145, Charing Cross Road, W.C.2.—Leaflet No. 82, advertising the company's battery charger for high-tension accumulators. Priced.

THE MULLARD WIRELESS SERVICE CO., LTD., Denmark Street, W.C.2.—Four illustrated and priced leaflets dealing with the construction and performance of the company's U.15, V.U. 150, S.4 and S.6, and U.12 valves.

Z ELECTRIC LAMP & SUPPLIES CO., LTD., 73, Newman Street, Oxford Street, W.1.—A list announcing reduced prices of the company's wires and cables.

MESSRS. MARELLI & Co., LTD., 19 and 20, Garlick Hill, Queen Victoria Street, E.C.4.—Pamphlets Nos. L/711, 722, and 733, describing many examples of the company's fans, including domestic, office, cabin, railway carriage and other types.

THE MARCONIPHONE CO., LTD., 210-212, Tottenham Court Road, W.1.—A coloured poster announcing the company's new 2-V valves. Priced.

THE RUNBAKEN MAGNETO CO., Tipping Street, Ardwick, Manchester.—A priced and illustrated leaflet describing two radio battery chargers (a.c. type).

THE CHLORIDE ELECTRICAL STORAGE CO., LTD., Clifton Junction, near Manchester.—Publication No. 86/8, dealing with the use of batteries in connection with "safety lighting" in kinemas. Also a blue and sepia photogravure poster advertising "Exide Monobloc" batteries.

THE L. P. S. ELECTRICAL CO., LTD., Avenue Road, Acton, W.3.—A pamphlet illustrating the company's universal test and battery clips. Priced.

THE ATHOL ENGINEERING CO., Seymour Road, Crumpsall, Manchester.—A circular letter announcing reductions in the prices of various radio components.

MESSRS. BAXTER & CAUNTER, LTD., 219, Tottenham Court Road, W.C.2.—June price list of electrical equipment and accessories of numerous types, including domestic appliances.

THE LONDON ELECTRIC WIRE CO. & SMITHS, LTD., Playhouse Yard, Golden Lane, E.C.1.—A list announcing reduced prices of "Litz" wire of various sizes.

THE AEROGEN CO., LTD., 36, Bolsover Street, Great Portland Street, W.1.—An illustrated brochure dealing with the "Kiesselbach" high-pressure thermal storage for boiler plant. The company holds the sole licence for the manufacture and sale of the plant in this country.

THE HART ACCUMULATOR CO., LTD., Stratford, E.15.—June calendar blotter advertising the company's batteries.

Bankruptcy Proceedings.

FRANCIS HUSBAND, "The Hollies," Sandpit Lane, St. Albans, engineer.—The public examination of this debtor was held recently at the Court House, St. Albans. The statement of affairs showed gross liabilities of £4,109, of which £4,074 was expected to rank, while the assets, estimated to realise £35, were all absorbed by preferential claims. Debtor attributed his failure to liability under guarantees on behalf of a limited company, judgments obtained against him under a building contract entered into by his wife, expenses of his wife's illness, bad debts and unemployment. In 1915 he and another formed a limited company with a nominal capital of £1,000 to carry on business as electrical engineers and manufacturers, debtor being allotted 700 £1 shares partly for £350 cash and partly as consideration for services to be rendered; he was appointed managing director of the company. In February, 1920, the concern went into voluntary liquidation. It had been successful at first, but later a slump occurred. Debtor was liable for debts amounting to £3,134 as guarantor on behalf of the company. The liquidator had stated that the assets of the company had been insufficient to meet the debenture holder's claims. Debtor said that between 1921 and 1926, with the exception of a few months' employment as an engineer, and while he was engaged on a contract for the supply of switchboards, he was without remunerative employment. In July, 1926, judgment was obtained against him for the balance of the purchase price of his house, which had since been taken possession of by the mortgagees. He regarded the purchase of this house as his wife's transaction. In November, 1926, a further judgment was obtained against him. The examination was adjourned.

L. BELL, trading as Charles Bell, Joseph Street, Bradford, mechanical and electrical engineer.—The public examination of this debtor was held recently at the County Court, Bradford. The statement of affairs showed ranking liabilities of £3,067, and there was a deficiency of £1,360. Debtor attributed his failure to bad trade, the coal strike, and insufficient capital. He stated that he commenced working with his father and uncle as mechanical and electrical engineers. For two years during the war he worked at various shell-filling factories, and on the death of his uncle returned to the firm. Subsequently the business was formed into a limited company with a nominal capital of £15,000. In February, 1926, the company went into voluntary liquidation and a dividend of 7s. 6d. in the £ was paid. Debtor then took over the stock, machinery and plant from the liquidators and commenced business on his own account. To enable him to pay the purchase price his father advanced him £1,680 on loan. He had since borrowed a further £150 from his father. During his trading the business showed a net loss of £184, and he became aware of his position early in January last. The examination was adjourned.

A. L. WEEKES, 13, Crescent Road, Luton, electrical engineer. The public examination of this debtor was held recently at the Court House, Luton. The statement of affairs showed liabilities of £527 and a deficiency of £524. Debtor stated that he commenced business on his own account in 1905, raising about £6,000 on a reversionary interest. In 1916 the business was formed into a company with an authorised capital of £10,000. Debtor realised the whole of his personal estate to pay off a bank overdraft of £10,000 in 1924, and the company then went into voluntary liquidation. The business was sold for £4,500, and the company was afterwards reconstructed. Debtor was appointed managing director, but subsequently he left that position. The examination was adjourned.

E. G. BATT, electrical engineer, 20, Iverna Gardens, Kensington, and Magnet House, Kingsway, W.C.—This bankrupt, who failed last November, applied on June 1st at the London Bankruptcy Court for an order of discharge. Mr. Walter Boyle, Senior Official Receiver, reported that the provable debts amounted to £2,911, and no assets were disclosed. The applicant, except from 1916 to 1919, when he was serving in the army, had been employed since 1915 as engineer to an electrical company, at a salary latterly of £720 per annum. He attributed his insolvency to his own personal extravagance. The application was opposed by the Official Receiver on statutory grounds, including unjustifiable extravagance in living. After hearing Mr. Stable on behalf of the bankrupt, Mr. Registrar Warmington granted an immediate discharge subject to a judgment for £300, to be satisfied by a cash payment, and revoked an existing order under which the bankrupt had to pay £100 per annum for the benefit of the creditors.

E. MACKINTOSH, electrical engineer, 57, Broughton Road, Edinburgh.—The estates of the above-named debtor were sequestrated by the Sheriff of Peebles on May 23rd; a meeting to elect a trustee and commissioners was held at 18, George Street, Edinburgh, on June 1st. Particulars of claims by September 23rd. Mr. R. F. Calder, agent, 12, Gayfield Square, Edinburgh.

E. M. LANCASTER, electrical engineer, 21, Hanover Lane, Leeds.—First meeting June 13th, at the Official Receiver's office, 24, Lower Bond Street, Leeds; public examination, June 28th, at the County Court House, Leeds.

H. L. SMITH, electrician, 156, Tredegar Road, Bow, E.—Application for discharge to be heard at Carey Street, W.C., on June 28th.

J. F. LYONS, electrical engineer, 25, Palmerston Street, and Front Street, Consett, Durham.—Trustee, Mr. C. Woollett, Official Receiver, Pearl Buildings, 4, Northumberland Street, Newcastle-on-Tyne, released July 27th, 1926.

B. G. THOMPKINS, radio engineer, Armstrong's Buildings, Stanley, Durham.—Trustee, Mr. R. W. Cave, Official Receiver, 81, St. Mary's Place, Newcastle-on-Tyne, released May 26th.

F. LENG (F. Leng & Co.), electrical and mechanical engineer, 12, Godstone Road, Rotherham.—First meeting to be held to-day (Friday) at the Official Receiver's offices, Figtree Lane, Sheffield. Public examination, July 7th, at the County Court Hall, Sheffield.

W. K. COXON (separate estate), trading with E. R. Weare as Western Manufacturing Co., wireless apparatus manufacturer, Nurshill, Lydney, Glos.—First and final dividend of 4s. 2½d. in the £ payable June 20th at 78, New Oxford Street, W.C.1.

G. C. LAZENBY, wireless engineer, 29, Old Town Street, Plymouth.—Receiving order made June 2nd, on debtor's own petition.

Company Liquidations.

CONRADI & BRAUN, LTD., radio manufacturers, 52, Theobald's Road, W.C.1.—A meeting of creditors was held on May 31st at the offices of Messrs. Fincham, Partridge and Co., 3, Warwick Court, Gray's Inn, W.C. Mr. F. W. Fincham, the liquidator in the voluntary liquidation of the company, reported that the liabilities were £1,181, all due to unsecured creditors. There were net assets of £1,137, leaving a deficiency, so far as the creditors were concerned, of £44. The company was registered in March, 1925, with a capital of £3,000, and acquired a business previously carried on by Mr. Braun. The assets were valued at £4,493, including £1,000 for goodwill. The liabilities were £1,495, leaving a surplus of £2,998. The company agreed to discharge the liabilities and the vendor was allotted fully-paid shares of the value of £2,998. The company continued the business and had had a fairly good turnover. Accounts for the period from October, 1924, to July, 1925, showed sales of £8,500 and a gross profit of £1,717. During the 12 months to July, 1926, the sales were £11,900, and the gross profit £2,904. Since August 1st of last year the sales had fallen off, and had only totalled £6,600, with a gross profit of £965. After allowing for all the expenses, there was a total net loss of £1,335. In May, in order to safeguard the assets, a resolution for voluntary liquidation was passed. There were only two shareholders, Mr. L. F. Braun and Mr. F. S. Conradi; they had been directors since the inception of the company. The chairman stated that the creditors would receive a substantial dividend, and the assets were not charged in any way. He did not think that there was any possibility of selling the business as a going concern. He proposed to close down the establishment at the end of that week, and realise the assets as quickly as possible. It was decided to confirm the voluntary liquidation of the company, with Mr. Fincham as liquidator.

SPRINGFIELD ELECTRIC MOTORS, LTD.—A meeting of members is called for July 1st at the offices of Messrs. Hepworth and Chadwick, 14, Butts Court, Albion Street, Leeds, to hear an account of the winding up from the liquidator, Mr. V. Walton.

S. M. F. ELECTRICAL SUPPLIES, LTD.—A meeting of members is called for July 2nd at 43, Oozells Street North, Birmingham, to hear an account of the winding up from the liquidator, Mr. E. J. Milton.

YATES & THOM, LTD., Blackburn.—A resolution for the voluntary liquidation of the company was passed at a meeting of shareholders on May 31st; a liquidator is to be appointed at a confirmatory meeting to be held at the end of this month. The chairman, Sir William Thom, said that the company would pay 20s. in the £ to creditors, shareholders, and stockholders. It is stated that the company intends to pay off the preference shares on June 30th, and at the same time to pay 10s. on account to the ordinary shareholders.

CORRECTA LIGHT CO., LTD.—Winding up voluntarily. Liquidator, Mr. C. A. Charlier.

ELECTRICAL WHOLESALE SUPPLIES (LEICESTER), LTD.—Winding up voluntarily. A meeting of creditors is called for June 14th at the offices of the liquidator. Particulars of claims by June 30th, to the liquidator, Mr. J. A. Hopps, 25, Friar Lane, Leicester.

Private Arrangements.

T. C. PRICE, wireless dealer, Horse Street, Dowlais, Glam.—A meeting of creditors was held on May 26th, when the representative of the General Electric Co., Ltd., was elected to the chair. The statement of affairs presented showed ranking liabilities of £621 and assets of £165, leaving a deficiency of £456. The debtor commenced business as an electrician in 1923, and later started a wireless business. During the year ended May, 1926, his turnover was £1,700, whilst during the year to May last the sales were £1,409. The expenses had aggregated approximately £600 per annum, that figure including drawings of £270. Debtor's wife and mother-in-law were shown as cash creditors, but it was stated that their claims would probably be withdrawn. A recent fire caused damage to the extent of about £45, but only £20 was received from the insurance company. A deed of assignment had previously been executed. On behalf of the debtor an offer was made of a composition, and a resolution was passed agreeing to accept 10s. in the £, payable in three instalments. It was also decided that Messrs. S. E. Clutterbuck and J. Williams should be appointed joint trustees, with a committee consisting of the representatives of the General Electric Co., Ltd., the South Wales Wireless Co., and Messrs. Capel and Co. The following are creditors:—

	£		£
Siemens Bros. & Co., Ltd.	23	Marconiphone Co., Ltd.	34
South Wales Wireless Co., Ltd.	44	Houghton-Butcher, Ltd.	24
Sloan Electrical Co., Ltd.	45	General Electric Co., Ltd.	39
Oldham & Sons, Ltd. ...	29	Brown Bros., Ltd. ...	37

EDWARD PINCOTT, trading as E. Pincott & Co., electrical and wireless engineers, 91, Queen Street, Exeter.—A meeting of creditors was held recently at the offices of Messrs. Poppleton, Appleby & Hawkins, 4, Charterhouse Square, E.C., when an approximate statement of affairs was submitted by Mr. E. H. Hawkins, which showed liabilities to the trade of £2,084, and cash creditors for £401. The net assets were £1,155. It was stated that three suppliers had levied execution, whilst other proceedings were threatened. A deed had been executed to Mr. Hawkins to protect the assets. The debtor attributed his present position largely to losses which he sustained on a branch business at Taunton, which had now been disposed of. The debtor estimated those losses at approximately £700, and he had also suffered through ill-health during the last three years. The cash creditors were relatives, and their claims would be withdrawn if the estate was dealt with under the deed. A resolution was passed confirming the deed with Mr. Hawkins as trustee, whilst a committee was also appointed, consisting of the representatives of the Chloride Electrical Storage Co., Ltd., the Sloan Electrical Co., Ltd., and Callender's Cable and Construction Co., Ltd. The following are creditors:—

	£		£
Sloan Electrical Co., Ltd.	156	General Electric Co., Ltd.	42
Siemens Bros. & Co., Ltd.	53	S. G. Brown, Ltd. ...	48
A. C. Hands & Sons ...	21	Walsall Hardware Mfg. Co., Ltd.	88
British Thomson-Houston Co., Ltd.	27	S.T. Valves, Ltd. ...	25
Igranic Electric Co., Ltd.	26	Chloride Electrical Storage Co., Ltd.	302
Automobile Accessories, Ltd.	94	Callender's Cable & Construction Co., Ltd. ...	153
Metro-Vick Supplies, Ltd.	31	Falk, Stadelmann and Co., Ltd.	62
Wholesale Fittings Co.	150	Simplex Conduits, Ltd.	118

G. R. HINKS, 74, Gravelly Hill North, Erdington, Birmingham, wireless dealer, &c.—At a recent meeting of creditors a statement of affairs was presented which showed liabilities of £381 due to unsecured creditors, and net assets of £83, leaving a deficiency of £298. It was stated that the debtor was at one time in the employ of a firm of wholesale dealers in Birmingham, but started trading on his own account in February, 1925, with little or no capital. The profits had not been sufficient to meet the expenses. In addition to the business, the debtor had been travelling on commission. He had been pressed by creditors, and in order to protect the estate a deed of assignment had already been executed to Mr. F. Sharratt, C.A., 174, Corporation Street, Birmingham. The business had been advertised for sale, and it was hoped that it would be disposed of at a figure which would allow of a reasonable dividend being paid to the creditors. The deed already executed was confirmed.

J. MURRAY YOUNG, electrical engineer, 9, Foundry Lane, Perth.—A meeting of creditors was held recently at the offices of Mr. J. T. Douglas, solicitor, Perth, when a statement of affairs was submitted which disclosed liabilities of £401 and net assets of £94, leaving a deficiency of £307. The statement therefore showed an apparent dividend of 4s. 8d. in the £, subject to expenses of realisation, &c. It was stated that a trust deed had already been executed by the debtor, and it was decided to confirm it. A committee of inspection was also appointed, consisting of Mr. C. E. P. White (representing Messrs. Frew & Co., Ltd., Perth), Mr. J. McDavid, and Mr. R. Scott Dempster.

Dissolutions of Partnership.

GREEN LANE WIRELESS STORES, retailers of wireless apparatus and accessories, 54, Green Lane, Derby.—Messrs. P. and F. W. Whitehead have dissolved partnership. Mr. F. W. Whitehead will attend to debts and continue the business.

ALAN BANTOCK & Co., electrical contractors, 34, Greenside Road, Shepherd's Bush, W.12.—Mr. A. Bantock, Mr. W. Henson, and Mr. T. E. Russell have dissolved partnership. Mr. Bantock will attend to debts and continue the business.

ACKERMAN & CRAWFORD, electrical and mechanical engineers, 32, Hockliffe Street, Leighton Buzzard.—Mr. A. C. Ackerman and Mr. R. K. Crawford have dissolved partnership.

For Sale.

By order of the Official Receiver of the Southern Counties Electric Light and Power Supply, Ltd. (in liquidation), Messrs. Senior & Godwin invite offers for one 50-h.p. semi-Diesel crude-oil engine, with air compressor, starter and fittings. West Central Merchandise Mart will sell by auction on June 29th, at 10, Red Lion Passage, W.C.1, cables and flex. (See our advertisement pages to-day.)

Indian Electrical Imports.

The imports of electrical equipment into India during March last attained a value of 25,00,000 rupees, as compared with 25,65,000 rupees in the corresponding month of 1926.

A New Cable Carton.

A new cable carton which has recently been put on the market by the ENFIELD CABLE WORKS, LTD., Lincoln House, London, W.C.1, should go far in overcoming the difficulties met with in connection with the packing of small wiring cables. It is in effect a strong cardboard reel with specially devised flanges which cover and fully protect the cable.

The flanges have slightly flexible cardboard rims, each extending half the distance between the two flanges, with rolled edges meeting in the centre and forming "lips." The rims are placed at right angles to the flanges, and have sufficient resilience to ensure a dust-tight joint at their meeting edges,

"Enfield" Cable Carton.

while allowing the easy withdrawal of the wire. As the cable is fed out the "lips" close, the unwound length being retained on the reel, and remaining always under cover of the rims. The cable draws out without kinking, and each turn is centralised on the reel as it is drawn out. It is claimed that it is impossible for the wire to become entangled by several turns slipping the reel and causing an unnecessary quantity of wire to slack off. The carton is sent out with an outer protecting wrapper around the rims, which the wireman simply tears off. Each carton carries a black or red label, according to the colour of the cable inside.

Prices of Raw Materials.

Messrs. F. Smith & Co. report, June 8th:—Copper (electrolytic) bars, £60 10s., 5s. inc.; ditto ditto sheets, no change; ditto ditto wire rods, £70 10s., 5s. inc.; ditto ditto h.c. wire, 8 15/16d., 1/16d. inc.

Messrs. James & Shakespeare report, June 8th:—No change in the prices of copper bars (best selected), sheet and rod; English pig lead, £26 10s., 15s. inc.

Messrs. Edward Till & Co. report, June 8th:—No change in the price of India-rubber, Para fine.

Lighting and Power Notes.

Australia.—BRISBANE (Q.).—The report on the working of the City Council's electricity undertaking (general manager: Mr. J. H. Hindman) for the year ended December 31st, 1926, shows a total revenue of £163,496, and expenditure, including interest, depreciation and renewals, of £141,646, leaving a net surplus of £21,850. The greater portion of the energy required is obtained in bulk from the Brisbane City Electric Light Co., Ltd. The sales of electricity amounted to 7,231,607 kWh, and the average price obtained was 5.453d. per kWh. During the year 12 miles of h.p. and 40 miles of l.p. mains were erected and 21 distribution transformers installed, increasing the total capacity to 1,825 kVA. A publicity department was inaugurated during the year with a view to increasing the demand for supply, and a deferred payment system was introduced.

Barrow.—ELECTRICITY EXTENSIONS.—At a meeting of the Town Council on May 31st it was reported that the Electricity Commissioners had not only sanctioned the extension of the Corporation electricity works, at a cost of £60,000, but had now sanctioned the loan. The £60,000 is made up as follows:—6,000-kW turbo-alternator, switchgear, pipework, and auxiliary plant, £30,000; boiler and auxiliary plant, £16,750; coal-handling plant and bunkers, £3,000; cooling tower and foundations, £2,000; pipework, £2,500; engine-room cranes, £750; contingencies, £5,000.

Birkenhead.—LOANS SANCTIONED.—The Corporation Electricity Committee has received sanction to the following loans:—£1,979 for the provision of a transformer station at Moreton; £1,495 for a transformer station at the Plymyard Estate, Eastham, and £5,558 for kiosks, transformers, and switchgear.

MAINS EXTENSIONS.—The Committee is to carry out extensions of mains at a cost of £3,845.

Blackburn.—INQUIRY.—In view of Dr. S. L. Pearce's inability to conduct the proposed inquiry into the administration of the Electricity Department, the Corporation has invited Mr. A. H. Dykes, consulting engineer, to do it.

Burnley.—ELECTRICITY SUPPLY.—The borough electrical engineer has been authorised to lay an e.h.p. feeder from the sub-station to the kiosk at Habergham Pit at an estimated cost of £3,200, and a feeder from the sub-station to Stephenson Street, at an estimated cost of £540.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—The Montreal Island Power Co., Ltd., has been formed for the purpose of developing a water-power site on the Rivieres des Prairies, about seven miles from Montreal. With a head of 26 ft., it is estimated that the plant to be constructed will be capable of developing 65,000 h.p. Work on the new plant will be started at once, and 40,000 h.p. will be available for delivery by the end of 1929. The output will be increased to 65,000 h.p. as required. All distribution problems have been eliminated by a long-term contract with the Montreal Light, Heat and Power Consolidated for purchase by this company of all power available.

Continental.—LUXEMBURG.—From the recently-issued report of the Compagnie Luxembourgeoise d'Electricité, principal attention was given last year to the construction of h.p. transmission lines for electricity supply in the Belgian provinces of Namur and Luxemburg. In the Namur province the main transmission line between On and Monceau, about 32 miles, is now in operation, together with three branches, totalling about 18 miles. In Luxemburg province a line is in use between On and Champlon, a distance of nearly 25 miles, together with four branches aggregating 13 miles. It is expected that the erection of the h.p. lines will be completed this year, and the company is now laying the l.p. distribution system.

BELGIUM.—In the recently-issued annual report of the Société des Centrales Electriques des Flandres, the directors state that as a result of the satisfactory results obtained with the experimental high-pressure boiler and turbine installed some time ago at Langerbrugge, they have decided to alter the whole of the steam-raising plant to the high-pressure system. With this object in view they have given orders for three boilers each capable of producing 99,000 lb. of steam per hour at a pressure of 796 lb. per sq. in., and at a temperature of 450 deg. C., and a first-stage single-casing turbo-generator of 66,000 kW capacity, at 3,000 r.p.m. The steam from this turbine will be afterwards utilised in three existing 284-lb. per sq. in. 6,600-kW turbo-generators. When the new plant is installed the Langerbrugge power station will have a total capacity of 38,000 kW, and its steam efficiency will be about 23 per cent.

BULGARIA.—The General Council of Tirnovo has decided to arrange an international competition for the electrification of the department of Tirnovo. Special attention will be paid to the question of cost and the system of electrification. Detailed regulations for the competition are being prepared, and projects must be received before January 1st, 1928. Two prizes will be awarded.—*Reuter's Trade Service* (Sofia).

Doncaster.—LOAN SANCTIONED.—The Electricity Commissioners have sanctioned the borrowing by the Town Council of £5,951 for sub-station building, mains, services, plant and meters.

Epsom.—LOAN SANCTIONED.—The Urban District Council has received sanction to a loan of £3,100 for laying mains on the Horton housing estate.

Eastbourne.—ELECTRICITY SUPPLY.—The Corporation Electricity Committee has received a letter from the Electricity Commissioners intimating that, as the result of further consideration, they are not satisfied that the proposal to lay a single-phase, 11,000-V main is one which can be approved. They state that, having regard to the developments which will take place in the course of the next two or three years, they are of opinion that the Council should provide for a 3-core ring main in order to bring its system into line with modern practice, and introduce a 3-phase system of supply. The Committee has decided to inform the Commissioners that it is prepared to recommend the adoption of a 3-core main and that, having regard to the urgency of the matter, they be asked to sanction the borrowing of the amount required for the h.p. cable for the ring main, *viz.*, £10,413, as soon as possible, and that the electrical engineer submit a revised application on the lines indicated.

Grampian Electricity Scheme.—EXTENSION OF TIME.—The *Financial News* reports that the Grampian Electricity Supply Co. has presented a petition to the Secretary of State for Scotland asking him to issue a Provisional Order extending for five years, from August 4th next, the time stipulated in 1922 within which the company must acquire the necessary lands in the counties of Perth and Inverness for the construction of the generating stations and other works required for the completion of the Grampian Electricity Scheme.

Guildford.—LOANS.—The Corporation Electricity Committee is applying for sanction to the borrowing of the following sums:—Mains, £7,500; meters, £2,500; public lamps, £500.

Haslingden.—BULK SUPPLY CHARGE.—The Corporation has asked for a reconsideration of the price charged by Accrington for electricity supplied in bulk. Mr. Clegg (borough electrical engineer) is conferring with the officials concerned regarding the terms of the existing agreement.

Isle of Wight.—REVOCATION OF ORDER.—The Minister of Transport has revoked the Newport, Ryde and Sandown, and Shanklin Electricity (Bulk Supply) Special Order, 1925, the revocation to take effect from May 27th.

Leeds.—NEW ELECTRICITY CHARGES.—The Corporation Electricity Committee has recommended the following new charges for electricity for heating purposes:—First 2,000 kWh per quarter, 1½d. per kWh; next 1,000 kWh, 1½d.; next 2,000 kWh, 1d.; over 5,000 kWh 0.9d. per kWh.

PROPOSED SUBWAYS.—At a joint meeting of the Corporation Committees consideration was given to a proposal to construct subways to carry the cables and pipes of all the city's services, and it was decided that the city engineer should obtain information on the subject.

London.—LEWISHAM.—The Borough Council has accepted the offer of the South Metropolitan Electric Light & Power Co. to install electric lighting at 34 houses at Grove Park and for public lighting. Each house is to have a prepayment meter, and the charges are to be 6d. per kWh, or 8½d. per kWh inclusive of rental of wiring, plain fittings, lamps, and one heating plug, or 1½d. per kWh with complete wiring, fittings, &c., and an additional charge per week of 1s. 2d. for a five-roomed house, and 1s. 1d. for a four-roomed house. For street lighting the charge is to be £4 15s. per 80 c.p. lamp per annum.

ST. MARYLEBONE.—The Borough Council has received sanction to the borrowing of £8,400 for transformers and switchgear.

KENSINGTON.—The Highways Committee of the Borough Council has renewed an agreement with the Notting Hill Electric Lighting Co., Ltd., for the supply of electrical energy for the lighting of street lamps at the rate of 1½d. per kWh for the period up to 1931. The Committee has also considered further extensions of electric street lighting and has recommended arrangements for the conversion from gas to electricity of an additional 396 lamps in the borough.

Manchester.—YEAR'S WORKING.—We have received from Mr. H. C. Lamb, chief electrical engineer and manager of the Corporation electricity undertaking, a copy of the abstract of accounts and report on the working of the undertaking for the year ended March 31st last. The total revenue amounted to £1,643,137, as compared with £1,426,238 in the preceding year. Working expenses increased from £789,313 to £984,107, for which the coal dispute was largely responsible, leaving a gross surplus of £659,031 (£636,925). From this surplus the following charges had to be met:—Interest, £256,199; sinking fund, £286,465; income tax, £75,708. The net profit was therefore £40,659, as compared with £32,857 in 1925-26. The capital expenditure during the year amounted to £524,441, the chief items being £329,030 for mains, and £84,692 for transformer and distributing stations. The total now expended on the undertaking stands at £9,141,156. The sales of electrical

energy increased from 300,440,765 to 323,547,741 kWh, and the electricity not accounted for amounted to 59,292,019 kWh, or 14.41 per cent., of the total generated (411,475,210 kWh). The maximum supply demanded was 140,860 kW, an increase of 4,750 kW. The average price obtained per kWh showed a slight increase from 1.12d. to 1.20d. No additions were made to the plant at Barton power station, but substantial advancement was made on preparatory work for the extensions now in progress, which will include a 40,000-kW turbo-alternator. Five new sub-stations were put into commission during the year, and extensions were carried out at 18 other stations. The mains laid amounted to 56 miles, bringing the total to approximately 820 miles. Good progress was made in the development of the cooker hiring scheme, and the number of cookers installed during the year was 1,533, bringing the total up to 3,029.

PROGRESS DURING APRIL.—During the month of April the electricity undertaking showed an increase in connections of 3,136 kW, bringing the total to 319,744 kW; and the number of applications received for supply, including consumers for additional supplies, was 964, representing a total of 2,771 kW. The number of hired cookers connected increased by 146, bringing the total actually on circuit to 3,175. Applications for the hire of cookers totalled 131. Two new sub-stations were put into commission at Blackley and at the works of Messrs. R. & J. Dempster, Ltd., and additional plant was installed at three existing stations.

Newark-on-Trent.—ELECTRICITY AGREEMENT.—The Town Council has entered into an agreement with Messrs. Ransome and Marles Bearing Co., Ltd., to supply a minimum of 850,000 kWh per annum.

New Zealand.—MANGAHAO SCHEME.—The *Electrical Engineer of Australia and New Zealand* states that interesting figures illustrating how the demand for electricity is growing in New Zealand appear in a recent issue of *Board and Council*. They refer to the Mangahao scheme, but may be taken as typical of conditions throughout the Dominion. So great has been the success of the scheme that the estimated power demand at the end of five years has already been exceeded, though the first bulk supply was commenced less than three years ago. These demands have severely strained the capacity of the Mangahao hydro-electric station, particularly as the season has been dry and the full water storage is not yet complete. At certain periods the station has had to be assisted by the steam plant of the Wellington City Council and by crude oil plants run by some of the local authorities.

Oldham.—LOANS—The Corporation Electricity Committee is applying for sanction to the following loans:—Superstructure, £36,575; structural steelwork, £19,500; switchgear, £41,000; economisers, £27,300; overhead travelling crane, £3,100; miscellaneous, including engineering, architects', and legal charges, £15,000; civil engineering work being carried out by direct labour—expenditure to March 25th, 1927, £8,500.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

YORKTOWN AND BLACKWATER.—*The Yorktown and Blackwater Gas and Electricity Co.*—Power: Reduced to a flat rate of 4½d. per kWh.

HEYWOOD.—The charges for electricity have been reduced to those prevailing prior to the coal dispute.

Sheffield.—ELECTRICITY EXTENSIONS.—During May the Electric Supply Committee approved extensions of mains for general distribution purposes at a cost of £11,032.

Shipley.—INAUGURATION OF PLANT.—The new plant which has been installed at the Urban District Council's electricity works is to be formally inaugurated on June 30th.

South Africa.—CAPE TOWN.—According to the *South African Engineer*, the City Council has given its approval to a proposal by the Electricity Supply Commission to build a small hydro-electric generating station near sea level almost immediately below the Steenbras waterworks tunnel exit at Gordon's Bay. This will be fed into the Commission's rural supply transmission system at its sub-station at the Cape Explosives Works, Somerset West. The station will probably contain, in the first instance, three 600-kW sets. The Commission will bear all costs involved in putting the scheme into operation.

The authority of the ratepayers has been received to raise a loan of £500,000 for extensions to the city electricity undertaking during the ensuing three years. The loan is made up as follows:—Land and buildings, £30,000; machinery, £87,750; distribution, £382,250.

South-East Lancashire Electricity Advisory Board.—GLOSSOP.—The Engineering Advisory Committee has received a communication from the Glossop Urban Electric Supply Co., Ltd., regarding a proposal to obtain a bulk supply of electricity, and has recommended the company to approach the Stalybridge, Hyde, Mossley, and Dukinfield Tramways and Electricity Board for a bulk supply.

FRINGE ORDERS.—The Board has been recommended to support the applications for Fringe Orders by Altrincham Electric Supply, Ltd., to supply in Ringway, and Buxton Corporation to supply in Chapel-en-le-Frith.

LEIGH BULK SUPPLY.—The Lancashire Electric Power Co., Ltd., proposes to lay a 33,000-V cable from Hill Top sub-station to a sub-station to be erected at Kirkhall Lane, for the purposes of supplying electricity in bulk to Leigh Corporation. The estimated cost of the scheme is £42,450, made up as follows:—Cable, £32,000; switchgear at Kirkhall sub-station, £3,200; two 4,000-kVA transformers, £6,000; sub-station building, £1,250. The Engineering Advisory Committee has recommended the Board to approve the proposal.

NEW MILLS.—Application is being made by the New Mills Urban District Council for a Special Order to supply electricity in its area, and the Board has been recommended to support the application.

STOCKPORT.—The Committee has received a report from Stockport Corporation on proposed extensions to its Millgate power station. The report states that the Millgate site is capable of being developed to a capacity of from 130,000 to 140,000 kW. The cost of the first section is estimated at £257,620, and would include one 25,000-kW turbo-alternator and four 50,000-lb. boilers. This section would raise the capacity of the station to 57,000 kW. The estimated cost of the whole extensions is £900,000. The Committee has requested the Corporation to furnish particulars which are usually submitted by undertakers in connection with applications for extensions and new stations, and has decided to inspect the station. The minutes of the proceedings of the Engineering Advisory Committee have been approved by the Board.

Special Orders.—Application has been made to the Electricity Commissioners by the Silsden Urban District Council to amend the Silsden Special Order authorising the Council to take over from the Yorkshire Electric Power Co. the supply of electricity in the area outlined in the Order.

The Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising Scarborough Corporation to supply electricity in the urban districts of Scalby and Filey and the rural district of Scarborough, and Chester City Council to supply in the urban district of Tarwin and part of the rural district of Tarwin.

Staveley.—NEW PLANT.—The Staveley Coal and Iron Co. last week installed the second of three 7,000-h.p. gas engines for the generation of electricity for private and public use in the district. Each engine will generate 5,000 kW, and is driven by blast furnace gases, while the exhaust gases are used for producing steam.

Stoke-on-Trent.—ELECTRICITY SUPPLY.—The Corporation Electricity Committee has agreed to give Messrs. Johnson Bros., Ltd., a 3-phase supply at the Imperial and Hanley Potteries, and to lay a 4-core distributor from Franklyn Street sub-station at a cost of £1,300.

The Committee has had correspondence with Mr. T. Riley, electrical contractor of Tunstall respecting a supply to Basford Hall estate, and has decided to lay the necessary mains to the houses subject to the payment by owners or occupiers of £15 per house.

Stourport.—STATION INAUGURATION.—The new generating station of the Shropshire, Worcestershire and Staffordshire Electric Power Co., which is described elsewhere in this issue, was formally inaugurated on June 2nd by the Prime Minister, in the presence of about 1,500 people, who included all the members of the Central Electricity Board and many other distinguished engineers. On arrival of the special train from London the visitors found the town beflagged for the occasion. Following his speech of welcome, Mr. E. Garcke, chairman of the company, presented Mr. and Mrs. Stanley Baldwin with souvenirs of the occasion. The Premier, in the course of his address said: "It has been one of the dreams of my life for many years to see electricity brought into our rural districts in the hope that one day we may find, at any rate, parts of England where electricity plays as great a part in the daily life of the poorest people as it does in Sweden and Switzerland. Apart from cheap production, the chief difficulty lies in bringing together producer and consumer. The country people must be told what electricity can do for them."

Mr. Baldwin described the new station as an integral part of the scheme approved by the Electricity Commissioners for the South-West and Midland districts. The next scheme of the Electricity Board would deal with Central England—a difficult district because it contained highly industrialised portions and an enormous rural area. He was told that the supply from Stourport would go as far as Cheltenham and Tewkesbury, Gloucester, and the Forest of Dean. That would be a natural link with the great industrial area of South Wales, and Stourport would be an essential part of the main arterial system of transmission which must be constructed from end to end of Great Britain.

Sir John F. C. Snell, chairman of the Electricity Commission, and Viscount Ednam also spoke. The proceedings were amplified by B.T.H. loud-speakers and broadcast by the B.B.C. The band of the 8th Battalion of the Worcestershire Regiment provided music during the afternoon, and tea was served in marquees on the lawn.

Tramway and Railway Notes.

Blackburn.—FARES.—The Corporation Tramways Committee has decided to inaugurate as an experiment penny fares for a period of six months on all sections of the tramway.

Continental.—SWITZERLAND.—The directors of the Berne-Neuenburg railway have decided on the electrification of the line. To finance the work the authorities of the Canton of Berne are providing a loan of £88,400, and the Swiss Government one of £136,000, while several other cantonal and local authorities are assisting in the scheme.

Glasgow.—NEW CARS.—The Corporation Tramways Committee has asked the manager, in preparing the specification for the construction of the 50 new cars to be purchased, to confer with the deputation appointed to inspect various tramway systems, and thereafter submit the specification to the sub-committee.

Gravesend.—PROPOSED ABANDONMENT OF TRAMWAYS.—In connection with the proposal of the Gravesend and Northfleet Electric Tramways, Ltd., to abandon the tramways in Gravesend and Northfleet and substitute motor-'buses, Mr. H. H. Brown, town clerk of Gravesend, has had interviews with the representatives of the company with regard to the reinstatement of the roads, &c., and the Highways Committee has recommended that the company be informed that the local authorities are not prepared to consider any offer involving preferential treatment for running of 'buses and adhere to their refusal to accept the company's offer of £2,500, and that if this is its final word they will have no alternative but to lodge a petition against the confirmation of the Provisional Order.

Leeds.—TRAMWAY SCHEME.—The Corporation Tramways Committee is considering a scheme for the construction of sleeper tramway track in lieu of the existing paved track in York Road from Harehills Lane to East End Park.

YEAR'S WORKING.—The accounts of the Corporation tramway undertaking for the year ended March 31st last show a net surplus of £50,736.

Manchester.—YEAR'S WORKING.—We have received from Mr. H. Mattinson, general manager and chief engineer of the Corporation tramway undertaking, a copy of the annual report, together with the abstract of accounts for the year ended March 31st last. The revenue account records a total income of £1,757,522, as compared with £1,787,711 in the preceding year, the decrease being due to the general strike, which was responsible for a loss in revenue of £46,000, and an estimated actual net loss of £26,000. The working expenditure amounted to £1,451,659, as against £1,395,192, leaving a gross profit of £305,863 (£392,519), to which was added interest on investments, &c., unemployment grants, and a balance from the Parcels Department, making a total of £335,814. There was a deficit on the motor-omnibus service, however, of £5,943, leaving £329,871 for disposal. This was dealt with as follows:—Interest, £111,677; debt redemption, £110,321; street improvements—interest and sinking fund, £8,908; rent of leased lines, £27,062; income tax, £26,575. The net surplus was, therefore, £45,328, which was transferred to the renewals account. The previous year's working resulted in a surplus of £116,608. The capital expenditure during the year amounted to £192,897, the chief items being £83,779 for depôt buildings, and £69,003 for rolling stock. The total now spent on the undertaking is £3,767,286. The number of passengers carried decreased from 317,644,753 to 310,559,874, for which the general strike was also responsible, but the car miles run rose from 22,567,759 to 22,783,254. The total revenue per car mile fell from 19.012d. to 18.514d., and the total consumption of electricity increased from 43,261,942 to 43,900,518 kWh. Reconstruction of permanent way was carried out in 22 streets.

Salford.—TRACK CONSTRUCTION.—The Corporation Tramways Committee is seeking approval to lay down the necessary tramway track and construct overhead equipment required to make a connection between the tramway of the Swinton and Pendlebury Urban District Council (now leased to the Corporation) and the light railway of the Barton-upon-Irwell Rural District Council (now leased to the South Lancashire Tramways Co.). The cost is estimated at £4,000.

South Africa.—THE NATAL ELECTRIFICATION.—The Minister of Railways, in introducing his estimates, gave the House some interesting information regarding the results obtained from the electrification of the Natal main line. According to the *South African Engineer*, under electrification the traffic capacity of the Natal main line had increased to 26,700 tons, compared with a limit of 22,000 tons under steam. With additional engines a capacity of 30,000 tons could be handled. The financial results of electrification showed that during the three months July to September, 1926—the first three months of the entire electrified section—there was a surplus of £129,548, whereas the surplus during the corresponding period of 1924, and the last three months under steam working, was £117,364. The extent to which electrification has increased the surplus, after providing for interest on capital and all other charges, is equal to £50,000 per annum.

Telegraph and Telephone Notes.

Bulgaria.—RADIO-TELEGRAPHY.—The Commission appointed to examine the tenders for the construction of wireless stations has recommended that the contract be given to the English Marconi Co., the price being 33 million leva, or about £50,000, and the Minister of Posts and Telegraphs has confirmed the decision. Two German firms and one French firm also competed for the contract.—*Reuter* (Sofia).

Among the apparatus to be installed at the stations, which will be at Sofia, will be a high-speed transmitter with anode power of 10 kW and a wave-length range between 36 and 72 metres. It will be used for communication with stations which are operated in England by Marconi's Wireless Telegraph Co., and through which Sofia will be in touch with the principal cities of the world. The Sofia stations will also contain a high-speed long-wave combined telegraph and telephone transmitter for communication with Vienna, with a wave range of from 2,000 to 4,000 metres; and all the necessary electricity supply equipment and reserve generating plant will be installed under the contract. For the receiving station a set of high-speed commercial receivers with a combined overall wave range of from 1,200 to 25,000 metres, and one short-wave non-radiating receiver with a wave range of from 15 to 100 metres, are to be supplied, and one complete set of apparatus for the Central Telegraph Office control of the transmitters and receivers which will be operated by the Postal and Telegraph Administration.

India.—RADIO-TELEGRAPHY.—India has kept well ahead in development, says the annual report of the Indian Posts and Telegraphs Department for 1925-26. She has now an efficient system of stations to meet immediate requirements and an organisation which will enable full advantage to be taken of future developments. The wireless stations in Burma and the Andaman Islands, which were erected in 1905, were among the earliest in the world for maintaining communication between fixed points on land. Coast stations for communicating with ships were erected a few years later at the principal ports and were followed by a chain of inland stations linking up the most important towns. Progress has called for a complete revision of regulations since the war; during the last five years a series of licences to suit various purposes has been brought into existence, and arrangements have been made for the issue of broadcast receiver licences on an extensive scale, broadcasting on a temporary basis being carried out by several radio clubs, which are allotted a share of the fees derived from licences. As regards new construction, only one large modern high-speed duplex wireless service between Madras and Rangoon has been inaugurated. A temporary direction-finding station was also erected at Karachi, and the results were of great value to shipping. Schemes have been approved for completely remodelling the coast stations at Karachi and Bombay and constructing permanent direction-finding stations to assist ships and aircraft, which work was in progress at the end of 1925-26, and arrangements have also been made for a temporary direction-finding station at the mouth of the Hooghly River to assist ships bound for the port of Calcutta.—*Reuter's Trade Service* (Bombay).

Radio Notes.

India.—STATION INAUGURATION.—The Viceroy will visit Bombay on July 23rd and will open the Indian Broadcasting Company's station, which is now practically complete. He will also open on that day the "beam" wireless-telegraph service to England.

Regional Broadcasting.—REDUCTION OF STATIONS.—Lord Gainford, vice-chairman of the British Broadcasting Corporation, speaking at Truro recently, is reported to have said that it was impossible to increase the size of the broadcast wave-band in view of the just requirements of the Army, War Office, Air, and commercial and marine services. The only alternative was to reduce the number of stations in Europe from 170 to 100. He hoped such a change would be adopted in the near future. There were 19 stations in Britain working on the broadcast wave-band, excluding Daventry. Their proposals were to decrease the number of British transmitters using the broadcast wave-band, for which exclusive wave-lengths would be granted to Britain, in an equitable international agreement. The objective was to bring to every listener the choice of a minimum of two contrasted programmes capable of reception on the cheapest and simplest apparatus. In addition, there would be the long-wave station at Daventry, giving a total of ten transmitters altogether. Lord Gainford was referring to the regional scheme under which the whole country will ultimately be served by five, six, or seven high-power stations using ten or more wave-lengths, so that it will be possible for each to send out two programmes on different wave-lengths.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Aberdeen.—June 13th. Ellon Castle Estates, Ltd. Electrical work at four blocks of houses. Messrs. Tawse and Allan, architects, 10, Bon Accord Square, Aberdeen.

Adwick-le-Street.—June 21st. Urban District Council. Cables, boxes, pillars, &c. (See this issue.)

Australia.—MELBOURNE.—August 15th. Postmaster-General's Department. One 55-ton 3-motor-type electrically-operated overhead travelling crane. (A.X. 4727.)*

SYDNEY.—July 18th. Municipal Council. Boiler-house equipment for the Bunnerong power station. (B.X. 3531.)*
August 15th. Generator neutral earthing resistance. (B.X. 3550.)*

Cheadle and Gatley.—June 28th. Electricity Department. Static transformer, e.h.p. switch cubicle, and transformer switch and distributor kiosk. (See this issue.)

Dundee.—June 24th. Electricity Department. Three 200-kVA outdoor-type transformers and two sets of 750-kW rotary convertors. (See this issue.)

Egypt.—Egyptian State Railways, Telegraphs and Telephones. Chief Inspecting Engineer, Queen Anne's Chambers, Broadway, S.W.1. Telegraph and telephone materials: wire, porcelain insulators, enamelled cable, copper binders and tapes, £E4,000 to £E4,300.—*Reuter's Trade Service* (Cairo).

Glasgow.—June 16th. Corporation. Electric lighting installations for 510 houses at Knightswood. Specifications from Town Clerk.

Greenock.—June 17th. Corporation. Supply and erection of 11,000-V overhead transmission line and transformers. (June 3rd.)

Hull.—June 16th. Electricity Department. Steel coal bunker and conveyor housing. (May 20th.)
Switchgear extensions. (May 27th.)
The Corporation Health Committee is to obtain tenders for the installation of electric stoves and wiring at the Sanatorium.

Kirkcaldy.—July 2nd. Electricity Department. L.p. a.c. distribution, l.p. and e.h.p. cables, boxes, and roadwork. (See this issue.)

Lanark.—June 13th. County Council Housing Department. Electric lighting installations for 100 houses at Carmyle, for 172 at Uddingston. Mr. P. C. Smith, Housing Department, Hamilton.

London.—STEPNEY.—July 11th. Electricity Supply Department. Boilers and boiler-house accessories, turbo-alternator, condenser, accessories, and switchgear. (June 3rd.)
H.M. OFFICE OF WORKS. June 13th. Fuseboards and fuses. (June 3rd.)

Manchester.—June 13th. Electricity Department. Seven 250-kVA static transformers. Mr. H. C. Lamb, chief engineer and manager, Town Hall, Manchester.

Marlborough. — Electricity Department. Additional underground feeder and overhead feeder. (May 27th.)

New Zealand.—WELLINGTON.—August 9th. Public Works Department. 1,500 suspension insulator strings and 470 strain insulator strings (B.X. 3533.)*

Nottingham. — June 21st. Electricity Department. General stores for 12 months. (June 3rd.)

Oldham.—June 11th. Electricity Department. Water-cooling towers, foundations, tanks, and circulating water pipes. (May 27th.)

Portsmouth. — Electricity Department. Transformers. (May 27th.)

Pudsey.—June 14th. Electric lighting installation at the School of Art. Specification from Education Department, County Hall, Wakefield.

Sheffield.—June 11th. Tramways and Motors Committee. Supply and erection of weighbridge. Mr. A. R. Fearnley, general manager, Division Street, Sheffield.

South Africa.—CAPE TOWN.—June 30th. South African Railways and Harbours Board. Gasfilled and vacuum lamps for 12 months. (B.X. 3518.)* Telegraph material. (B.X. 3519.)*

ELLIOTT (C.P.).—June 15th. Municipal Council. Electric lighting plant, including engines and dynamos, steel poles, copper wire, insulators, switchboard meters, house-service fuses and street-lighting brackets and suspension fittings.
EDENBURG (O.F.S.).—June 21st. Municipal Council. Electric lighting plant, including engines, dynamos, steel poles, &c.

Southend-on-Sea.—July 6th. Light Railways and Electricity Department. L.p. and e.h.p. cables for 12 months. (June 3rd.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Birkenhead.—Electricity Committee. Accepted:—
10,850 yd. cable (£2,365).—Macintosh Cable Co., Ltd.

Bolton.—Electricity Committee. Accepted:—
Alterations and repairs to two rotary convertors at Duncan Street sub-station.—Metropolitan-Vickers Electrical Co., Ltd.

Burton-on-Trent.—Electricity Committee. Accepted:—
High-tension feeders, transformers, switchgear and low-tension feeders for supply to Stretton, Rolleston and Tutbury (£16,177).—Johnson & Phillips, Ltd.

Doncaster.—Electricity Committee. Accepted:—
L.p. cables (£2,621).—Hogan & Wardrop. This matter is referred to in our "Business Notices."
E.h.p. cables (£364).—Callender's Cable & Construction Co., Ltd.
Circulating-water pipework (£657).—Johnson & Moore.
Water intake from canal, pipework and screen (£1,775).—J. Holmes.

Grimsby.—Electricity Committee. Recommended:—
E.h.p. feeder cable and pilot cable (£2,597).—Johnson and Phillips, Ltd.
L.p. feeder cable (£1,236).—Connolly's (Blackley), Ltd.

India.—Great Indian Peninsula Railway.
269 miles of overhead line on lattice steel towers, for the supply of current to the railway from Igatpuri to Poona (approximately £300,000).—W. T. Henley's Telegraph Works Co., Ltd. Reference is made to this contract in our "Business and Industrial Notes" pages.

Leeds.—Electricity Committee. Accepted:—
Cables (£2,138), Enfield Cable Works, Ltd.; (£2,738), W. T. Henley's Telegraph Works Co., Ltd.; (£1,840), Hackbridge Cable Co., Ltd.; and (£14,047), Macintosh Cable Co., Ltd.
Switchgear (£232).—Yorkshire Switchgear & Engineering Co., Ltd., and (£297), H. J. Fuller & Sons.
Tramways Committee. Accepted:—
Two reciprocating rail grinders (£1,063).—Equipment and Engineering Co., Ltd.
Repairs to economiser at generating station (£1,251)—B. Green & Son, Ltd.
Town Hall Committee. Accepted:—
Electric fan blower for town hall organ (£245).—Abbott and Smith.

Maidstone.—Town Council. Accepted:—
Overhead materials for the trolley vehicle service.—British Insulated Cables, Ltd. (£186), and Wiseman, Ltd. (£162).

Oldham.—Education Committee. Accepted:—
Electric lighting installations at Werneth and Clarksfield housewifery centres.—W. Caton & Sons.

Plymouth.—Electricity Committee. Accepted:—
Transformers.—British Electric Transformer Co., Ltd.
A.c. meters.—Metropolitan-Vickers Electrical Co., Ltd.
D.c. meters.—Ferranti, Ltd.
Cables.—British Insulated Cables, Ltd.

Selkirk.—Town Council. Accepted:—
Electric lighting installation for the Victoria Halls (£319).—Jas. Kilpatrick & Son, Ltd.

Sheffield.—Electricity Committee. Accepted:—
Materials and work for lining steel coal bunkers at Neepsend (£499).—George Longden & Son, Ltd.

Tramways Committee. Accepted:—
20 pairs twin movable connected points (£2,515); 3 standard crossings (£84).—Hadfields, Ltd.
12 leg type crossings (£539).—Titan Trackwork Co., Ltd.
Six leg type crossings (£332).—Edgar Allen & Co., Ltd.

Forthcoming Events.

Physical Society.—Friday, June 10th. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary meeting.

Heat Engine Trials Committee.—Friday, June 10th. Institution of Civil Engineers. 6 p.m. Discussion on the Report on the Results of Heat Engine Trials.

Illuminating Engineering Society.—Tuesday, June 14th. Stationers' Hall, E.C.4. 6 p.m. Discussion on "The Relation between Illumination and Fine Work," to be opened by Mr. H. C. Weston.

Institution of Electrical Engineers.—Summer meeting. Newcastle-on-Tyne. June 14th to 17th.

Röntgen Society.—Tuesday, June 14th. 1, Wimpole Street, W. Silvanus Thompson Memorial lecture, "The Structure of the Atom and Radiation." Prof. Sir J. J. Thomson, F.R.S.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

MICRO tube heaters.
DAISY washing machines.
Anthony's patent boiler feed pumps as made by Messrs. Robert Warner.

Notes.

Electric Heating in an Operating Theatre.

A successful method of utilising electricity for a special heating purpose in exceptional circumstances has been applied to the operating theatre of the Harwich and District Cottage Hospital. The hospital is equipped with a central heating system and, in order that the operating theatre might be kept at a suitable temperature, it was found necessary to keep the main boiler going practically all the year round and at times when it was not required for the general heating of the hospital. The aim of the managerial staff was to raise the temperature of the operating theatre during periods when the main system was shut down and extra heat was necessary, the process to occupy about 30 minutes, but the problem was accentuated by the fact that whatever system was employed, owing to the lack of space, the apparatus had to be of a type that could be easily and quickly removable after performing its duty. The solution was the adoption of a portable electric radiator, the success of which in actual service has been of a pronounced character. The apparatus is of the "Magnet" type manufactured by the General Electric Co., Ltd., loaded to 12 kW, and the desired temperature is obtained well within the time required. A tray is provided for the flexibles, so that they may be quickly disposed of when the radiator is wheeled out of the theatre. This method of heating should commend itself to many other authorities where similar circumstances exist.

Non-Ferrous Metals Research Association.

The seventh annual report of the British Non-Ferrous Metals Research Association, for the year ended December 31st, 1926, shows that during the year the membership increased from 139 to 144. The income of the Association from its industrial members increased by £1,164 over that for the previous year to £9,155, and the minimum income condition on which the Government grant depends has been fulfilled. Over £25,000 was expended during the period under review on various researches. Considerable efforts have been made to improve the form of the Association's reports, and a special conference of the Association's investigators has recently been held to consider this question. During the year forty-two investigators were working on the researches, and over fifty research reports have been placed at the disposal of members. The following have joined the Council by co-option:—Prof. D. Hanson, D.Sc., Mr. J. Leechman, and Dr. C. R. Young. The Association is co-operating in a scheme for linking the Government service interests in electro-deposition with industrial developments and applications. The arrangements made by the Department of Scientific and Industrial Research have provided a sum of £5,000 to be expended over three years for the investigations. The Association is contributing a small fraction of the cost and is participating in the results of all the work.

The Shannon Power Scheme.

In a paper on "The Shannon Power Development Scheme," by Prof. S. W. Perrott, M.Inst.C.E., read before the Liverpool Engineering Society, the author gives a *résumé* of the work which is being done in connection with the Shannon hydro-electric development. It is estimated that the average flow of the river is about 12,400 cu. ft. of water per second for the whole year, the flow being very large in the winter and very small in the summer. In the total development, which is to produce 180,000 h.p., it is intended to raise the levels of Lough Allen, Lough Rea, and Lough Derg, so as to give a gross storage of 29,800 million cu. ft. From the intake to the power house the head race runs a distance of 6.46 miles. It is intended to keep the water level in the head race almost at the same level as in Lough Derg, so as to provide a head of from 90 to 100 ft. near the power house. The construction of the head race will necessitate the excavation of some six to seven million cu. yd. of earth, and over one million cu. yd. of rock. The tail race, which is over a mile long, will entail the removal of over a million cu. yd. of earth, and the same amount of rock. To provide an even discharge of water from the tail race into the Shannon, the bed of the latter will need deepening at several points below the mouth of the race, totalling about 1.2 miles. It is intended to admit boats to the tail race, and beside the power house a ship lift is to be provided to enable the vessels to be raised to the level of the head race. For the full development the calculated water level in Lough Derg is taken as 117 ft. for the highest and 105 ft. for the lowest level. The concreting operations on the construction of the weir sills, &c., are being carried out with the help of a cable way having a 1,300-ft. span, with towers 130 ft. high. The excavation of the head race is being carried out by means of electric dredgers which are supplied from a 300-metre length of loop line running loosely in guards. A portable transformer wagon running on a 3-ft. gauge track is stationed at the end of the line, which it feeds at 3,000 V, transforming from 17,000 V. The main motor of the dredger is fed at the high pressure, while a second transformer feeds the compressor and winch motors at 380 V. When a 300-metre section is completed the loop-line wires are pulled through another 300 metres without causing much delay to the excavating. In this way 600 metres of the canal may be dealt with without changing the position of the transformer wagon. The bucket excavators consume from 0.5 to 0.9 kWh per cu. m. The temporary power station at Ardnacrusha, which has been erected to supply electricity to the works, is equipped with seven 560-kVA and two 300-kVA Diesel-driven generators. The paper was illustrated by means of lantern slides.

Power Transmission by Radio.

"Beams of radio power, criss-crossing a city like searchlight rays and carrying light and power as wires do now," were discussed as future scientific possibilities, following spectacular demonstrations by two Westinghouse engineers, Dr. Harvey C. Rentschler and Dr. Phillips Thomas, to the New York Electrical Society recently. Electric lamps held by Dr. Thomas glowed brightly, although not connected to power wires; in a novel furnace displayed by Dr. Rentschler chemical reactions possible only in a vacuum were initiated by radio waves; and a disk of metallic tungsten was heated white hot "in an instant" by the rays. Dr. Thomas, who is research engineer of the Westinghouse Electric and Manufacturing Company, U.S.A., generated before the Society waves as short as 240 centimetres (8 feet) and predicted that still shorter waves will be produced, capable of being concentrated into narrow and powerful beams. "We may visualise," he said, "a parallel beam of radiation 10 centimetres (4 inches across) along which is being sent 10 kW of energy; imagine each house furnished with a half-wave oscillator in line with a parallel beam from a sending station, so that heat and light may be obtained very much as at present, by simply turning a switch, but without the costly transmission wire equipment now required. Again, suppose the beam of highly-concentrated energy should render conducting the air through which it passes; then ordinary electric power could be sent along the beam as though the beam were a transmission line and the beam could be directed to any desired spot, with dire results to the target."

The furnace demonstrated to the Society by Dr. Rentschler, who is director of research of the Westinghouse Lamp Com-

pany, is designed to concentrate large amounts of radio power within a small space; certain metals, although long known to chemists, cannot be prepared usefully in metallic form by ordinary methods because they are combustible when in fine powder form, taking fire in air whenever they are heated. By conducting the heating of these inflammable metals with radio power and in a vacuum, Dr. Rentschler has made them in metallic form and in some quantity. Two of these metals, thorium and uranium, belong to the group of radio-active metals including radium. Now that the use of the vacuum radio furnace has made these peculiar metals available, it is expected to find uses for them, Dr. Rentschler said, in industry. Another use of the radio furnace is to turn metals like gold and silver into gases, so that their individual atoms can be studied and weighed, with results of important value to atomic science.

Rural Development in Warwickshire.

Speaking at the recent opening of the new electricity showroom at Solihull, to meet the convenience and rapidly-growing requirements of consumers in the area of the rural district of Solihull, in which the Birmingham City Electricity Department is now furnishing electricity, Councillor Beale, chairman of the Electricity Committee, stated that 38 miles of mains had been laid in Olton, Shirley and Solihull, and £53,000 spent in the district. 570 consumers were already connected, a good record, seeing that they were not able to commence work until the Order from the Electricity Commissioners was obtained in March, 1926. They hoped to spread out towards Knowle and Dorridge in the autumn, and proposed to construct a ring main so that supplies could be afforded to villages in the neighbourhood if justified by the demand. The agricultural use of electricity was one means by which the demand might be extended.

The Association of Consulting Engineers.

The proceedings at the annual meeting on May 27th and the Committee's report for the year ended April 30th, 1927, indicate the total membership to be 112, new members elected during the year numbering 5. Objection having been raised to the system of classification adopted in order to assist those requiring the services of engineers practising in any particular branches to know which members devote themselves to these special branches, the Committee ascertained the opinion of the whole body of members, with the result that an overwhelming proportion desired no change. The Department of Overseas Trade suggests that when the Association is informed that engineering schemes are under consideration in different places abroad, English consulting engineers should offer their services. Under the rules of the Association and of the Institutions of Civil, Electrical and Mechanical Engineers such a practice is not allowed, but the Department is of the opinion that such a rule, "while doubtless of great use in the United Kingdom, must inevitably lead to loss of opportunities for practice in countries where such a rule does not operate, and where engineers of the same type are normally free to use any legitimate means to influence public authorities to employ them." It is hoped to report more fully to members the result of joint deliberations. Amongst other matters on which the advice of the Committee was sought during the year was as to the proper fees to be charged in certain cases. The Committee has considered the Bill now before Parliament for the registration of architects, which is being opposed by the Institution of Civil Engineers, and has associated itself with the opposition.

Mr. J. W. E. Binnie, chairman, pointed out that the Association would shortly be celebrating its coming-of-age, and he would like to see Mr. A. H. Dykes (hon. secretary) occupying the chair that year. Some discussion took place with regard to the opposition to the Architects' Bill, after which the report was adopted. Mr. S. C. Lewis, hon. treasurer, reported that the financial position of the Association was sound: the income and expenditure account showed a substantial saving in the year; there was a balance in hand last year of £50 on deposit and a cash balance of £154. The income was £475 and the expenditure £403. The accounts were adopted, and the chairman announced that the new members elected to the Committee were:—London members: Mr. H. J. Dean, Mr. S. B. Donkin, Mr. W. Vaux Graham, and Mr. Walter Mansergh; country members: Mr. David Balfour and Mr. Ravenshaw.

Transformer Ratio and Phase Displacement.

In a paper published in the April issue of the I.E.E. *Journal*, Mr. B. G. Churcher, A.M.I.E.E., describes null methods of measuring the ratio and phase displacement of two alternating voltages which are particularly applicable to high voltages and are discussed in connection with the testing of power and potential transformers. An important feature is the use of a capacitance potential divider in place of the resistance type hitherto used; it possesses considerable advantages from the point of view of simplicity and low cost of equipment and ease of operation, while accuracy can be made as high as is desired, and there is practically no limit to the voltage at which capacitance dividers can be used. The theory of a method of measuring the ratio and phase displacement of transformers is outlined and its operation is illustrated by a test on a 66,000-volt potential transformer. Suggestions are made for developing apparatus for routine industrial testing, and it is pointed out that robust construction and adequate safety to the operator could be secured while retaining ample accuracy for commercial purposes. Tapping the secondary winding of a high-voltage testing transformer for the purpose of operating a wattmeter or voltmeter is considered, and a method of determining the ratio and phase displacement of the full and fractional voltages is explained. The testing of high-voltage potential dividers is also briefly considered.

A Low-Fall Hydro-Electric Installation.

Some interesting particulars are given in the *Implement and Machinery Review* of a small hydro-electric installation which has been put down on the site of an old water wheel on the farm of General Hildebrand at Higham, near Colchester, where, at low-water times, a fall as low as 18 in. is utilised. A "Pitman" Francis vertical-shaft turbine of about 12 b.h.p. drives a compound-wound electric generator through bevel gearing. A raw-hide pinion wheel on the lay shaft renders the plant silent in operation. A balanced flywheel and a flexible insulated coupling are used to assist the governing. The turbine has movable guide vanes operated by a "Pitman" oil-pressure governor. The plant runs in conjunction with a battery which supplies electricity for lighting the farm at 50 V. Power for various machines on the farm is supplied from the generator direct at 100 V. The installation was put in by Mr. Percy Pitman, M.I.Mech.E.

Voltage Standardisation in the Dutch East Indies.

The need of some degree of standardisation of voltage has been for some time under consideration, and it has recently been decided that, in the case of direct current, 110, 220, and 600 V are to be the standards with 440 V as a recognised "outsider"; the 110 voltage is intended for small individual installations, 220 V for general use for lighting and power purposes, and 600 V for power distribution, including street-railway supply. In the case of alternating current, 50 periods is to be the standard frequency and 220 V for power, 127 V for lighting, and 380 V for large power installations, with expert supervision; existing a.c. installations at 110, 190, and 500 V are still to be recognised and provided for. As regards h.p. installations, 6,000 V is to be regarded as the limit for large generators and distributing systems, 10,000 V having been found too high, owing to the climatic conditions. For h.p. overhead transmission purposes 30,000 V is to be the standard with recognised "outsiders" of 3,000, 15,000, and 25,000 V.

Fatality.

Whilst watching the boats on the Thames from the riverside gardens of the Sun Hotel, Richmond-on-Thames, on June 7th, Paul Barrett, of Chiswick, grasped a wire which ran from a flagstaff connecting it with electric wires used in the illumination of the gardens, and received a fatal electric shock.

Broadcast Radio Coverage of City Areas.

Mr. Lloyd Espenschied, of the American Telephone and Telegraph Co., recently published in the A.I.E.E. *Journal* some of the results of a systematic study which was made of the "coverage" of the New York metropolitan area, which portray some of the general requirements of a broadcasting system. Two types of transmission wave component are involved: one delivers directly to the receiving area immediately surrounding a broadcasting station a field capable of reliable high-grade reception; and another, transmitted through the higher altitudes, permits distant reception, but not with the reliability and freedom from interference required of high-grade reproduction. The day and night fields are roughly the same: fading commences between 50 and 100 miles from the stations and the range of the fluctuations increases to the maximum distance observed. A fact of importance is that "fading," which ordinarily is noticed at distances of the order of 100 miles, may under some conditions become prominent at distances as short as 20 miles from the transmitting station. Such short-distance fading appears to be a case of unusually high attenuation, caused by a tall building area greatly weakening the directly transmitted wave so as to enable the effect of the indirect wave component to become pronounced at night.

1. Field strengths of the order of 50,000 or 100,000 μ V per m appear to be about as strong as one should ordinarily desire; fields much stronger than this impose a handicap upon those wishing to receive some other station.

2. Fields between 50,000 and 10,000 μ V per m represent a very desirable operating level, which is ordinarily free from interference and may be expected to give reliable year-round reception, except for occasional interference from nearby thunderstorms.

3. Below 1,000 μ V per m reception becomes distinctly unreliable, and is generally poor in summer.

A 5-kW station may be expected to deliver a field of 10,000 microvolts some 10 to 20 miles away, and a 1,000-microvolt field not more than 50 miles, which fact indicates clearly the need for the employment of higher transmitting powers. The range goes up with the increase of power disappointingly slowly; even were no absorption present in the transmitting medium, the range in respect of overcoming interference would increase only as the square root of the increase in power. To extend the 10,000-microvolt field from 15 to 30

miles would necessitate an increase in the radiated power from about 5 to 100 kW. The "shadows" cast by the areas of high buildings are prominent; distribution effected from a location well outside of the suburbs is an attempt to encompass within the range of the station a widespread area and so to include the city within that area as to effect a more uniform distribution over it than is possible when transmitting from a location within the city.

Regarding the important factor of frequency selectivity for multi-station operation, receiving circuits group themselves into three classes in the order of their selectivity merit as follows:—

1. The single-tuned circuit (non-regenerative and regenerative), and the combination of two tuned circuits coupled together.
2. Circuits employing radio-frequency amplification with tuned circuits between stages.
3. The double-detection or superheterodyne type of circuit.

Attention is called to the fact that the various circuits attenuate *within* the desired transmission band of 5 or 10 kilocycles, which means that the higher-frequency components of the side band will be reduced (after detection) with corresponding distortion of the reproduction; the distortion is greater for the more highly selective sets, following from the nature of sharply-tuned circuits. Selective circuits, capable of approximating the filter type of characteristic, are to be desired.

Loud-speaker reproduction indicates that ordinarily a level of the average of the undesired signal 40 TU (power ratio) lower than that of the desired signal, while not introducing noticeable interference at times when the desired signal is strong, does permit the undesired signal to "show through" when the programme rendition is weak; reducing the undesired signal to 60 TU below the desired signal prevents this interference for the volume ranges which are now commonly transmitted.

When locating a new transmitting station it should be possible from a knowledge of the relative field strengths of other stations in the vicinity to predict approximately what the interference area will be for different types of receiving sets. In this connection there should be recognised the advantage from the interference standpoint which exists in grouping together the broadcast transmitting stations in one location, and in equalising their powers, to enable receivers to obtain substantially equal fields from all of the stations and minimise the selectivity which they are required to possess. While it is impracticable to accomplish this result completely, it is hoped that a better understanding of the mutual advantage to be gained from reducing interference will lead naturally to better co-ordination.

Flies and Dust.

In a letter to the *Daily Telegraph*, Mr. A. Moore Hogarth, chairman of the College of Pestology, says: It is gratifying to remark that the Prime Minister in his reference to electricity emphasised the note of cleanness. There is something within us all which responds to things clean; we may not be conscious of it, but a clean shop, a clean factory, a clean man, a clean house, gives us a feeling of wholesomeness and evokes an immediate response. I doubt if there is a more clean place in the world than our London electric railways; flies are practically an unknown quantity there, and it would seem that the ozone generated by the electric current is inimical to pests, but whether this be true or not it is certainly true that before flies and other living minute evils reach maturity they are capable of being completely annihilated by electricity harnessed into various forms, by which these particles of living dirt can be sucked out of their nurseries. Just recently I incubated one dram weight of dust from a suction sweeper, and I got as a result two flies and one flea. There is nothing to stir the imagination in such a small result, but there it is as an evidence of possibilities.

The Manufacture of Aluminium in Canada.

A large plant for the manufacture of aluminium has been established at the new township of Arvida in Quebec, by the Aluminium Company of Canada, in which a part of the enormous power of the River Saguenay will be utilised. The raw material will be cryolite from Greenland and bauxite from South America, and both of these materials will be previously refined and ground before being sent to Arvida, the bauxite being received in the form of pure alumina. The process is electrolytic, and consists briefly in passing a direct current through a molten bath of cryolite in which alumina to the extent of about 15 per cent. is dissolved, thus forming the electrolyte, to which fluorspar or other fluorides may be added in order to reduce the melting point of the mixture below the temperature desired for furnace operation. The current passes from carbon anodes through the electrolyte to the baked carbon lining of the furnace, which serves as the cathode. The metallic aluminium accumulates in a molten condition at the bottom of the furnace, where it is protected from oxidation by the bath of cryolite above it.

Provision is made for recovering the carbon of the used electrodes, for separating the iron therefrom by magnetic separators, and also for utilising other material, such as the green scrap from the hydraulic presses used in electrode manufacture. This used and waste material is conveyed to the mixing room, together with fresh supplies of ground coke and pitch, to be blended, pressed, and baked. The production of new electrodes is an essential part of the operations, and occupies a considerable proportion of the plant layout.

At Arvida there will be ultimately 40 furnace rooms, each containing 100 furnaces all running electrically in series; the voltage drop through any one pot is about 6 volts. Considerable skill is required in properly starting up a furnace room, and the electrolytic process must be very carefully controlled, especially in noting what is called the "anode effect." As electrolysis proceeds the concentration of alumina dissolved in the cryolite necessarily decreases, and ultimately reaches a point at which the anode effect occurs. The resistance of the furnace then rises sharply, the voltage jumps to several times its normal value, the electrolyte no longer "wets" the anodes, and the latter appear to be surrounded by a gaseous film through which a kind of glow discharge takes place. The duration of this anode effect must be reduced to a minimum, and is achieved by means of a system of lamp signals which indicate at once when the "effect" begins. The crust of "frozen" electrolyte on the surface of the bath is then broken with a crow-bar and stirred into the electrolyte beneath, thereby increasing the strength of the solution. Necessary anode adjustments are also made, and a small quantity of powdered aluminium is sprinkled on the surface of the newly-formed crust and stirred in at the next working. Theoretically it is possible to dissolve nearly 20 per cent. of alumina in molten cryolite, but this is not possible in practice, as the rate of solution is slow, and there is a risk that undissolved alumina may settle through the electrolyte to the bottom of the furnace. The maximum concentration of the solution must therefore be kept low, and the anode effect consequently occurs at frequent and regular intervals if the furnace is properly worked.

In the manufacture of one pound of aluminium about ¾ to 1 pound of carbon is used, and the energy consumption is probably in the neighbourhood of 12.5 kWh, but this has not yet been definitely determined at Arvida. A group bonus scheme has been introduced to speed-up output. The tapping of the furnaces and the collection of the molten aluminium are comparatively simple operations, but require great care and also strict analytical control of the resulting product to ensure that it is up to quality and free from iron and other impurities. The ultimate capacity of the Arvida plant is estimated at 300,000 tons of metallic aluminium per annum, or about twice the present world output. Numerous new uses and a great expansion of present uses will have to be found to absorb such an output.

Electric Steel Works in India.

In an instructive paper recently read before the Royal Society of Arts, on "The Iron and Steel Industry of India," Mr. R. Mather, B.Met., late metallurgical inspector, Government of India, points out that the industry is based entirely on indigenous materials with sufficient reserves to provide all the steel required by the country for at least one hundred years. The erection of electric steel works (of which the proprietors are Sir Sarupchand Hukumchand & Co.) was commenced in 1920 and the manufacture of steel began in 1922; the plant is situated at Ballygunge, a suburb of Calcutta, and consists of two 2-ton electric furnaces and a foundry for the production of steel castings. Electric power is obtained from the Calcutta Electric Power Corporation at rates which would not exceed ½ anna per kWh if the works were in full and continuous operation; the output of steel has never been more than a small proportion of the capacity, the production of castings having been about 510 tons in 1924, 760 tons in 1925, and 390 tons in 1926. During the last year, however, the works produced also about 150 tons of steel for springs, as it has acquired small rolling mills (20, 16 and 10-in., respectively), part of which it proposes to erect for the purpose of producing spring bar and other kinds of high-carbon bar.

The development of the steel-making plant and rolling mills at Jamshedpur, 157 miles west of Calcutta, of the Tata Iron and Steel Co., which produces two-thirds of the pig iron and almost all the steel made in India, has been important; the original open-hearth plant has been enlarged. The rolling mills originally erected by the Company were all steam-driven and of relatively small capacity; they have now been supplemented and almost superseded by the large equipment of new mills, all electrically driven, which came into operation in 1923 and 1924. Of nearly 35,000 tons of rolled steel produced in a recent month less than 5,000 tons were rolled on the old mills.

Standardisation in France.

A lecture by M. Tribot-Laspière, general secretary of the Union des Syndicats de l'Electricité, reported in *Génie Civil*, deals with the Association Française de Normalisation, which was formed last year, and corresponds with the B.E.S.A. in this country. It is pointed out that standardisation has been carried out in Germany for several years, with the help of the Government, which recently allotted a sum of 2½ million marks to the purpose, and that there is a risk that foreign buyers will adopt German standards and purchase German goods. Many standards have been promulgated in France by various bodies, including 41 set up by the Union des Syndicats de l'Electricité, but there was no central organisation for the purpose until the Association was formed ("A.F. Nor"). It will furnish information regarding French stand-

ards to foreigners, and regarding foreign industries to French manufacturers, and will be able to take part in the International Standardisation Association which is likely to be established in September next.

Appointments Vacant.

Engineer for the electrical department of the Government of the Punjab. Showroom sales and publicity superintendent (£300) and lady showroom demonstrator (£220), for the Leyton Corporation Electricity Department. Temporary shift engineer for the Eccles Corporation electricity works. Borough electrical engineer and manager (£1,250), for the Bolton Corporation electricity undertaking. (See our advertisement pages to-day.)

Institution Notes.

Institution of Electrical Engineers.

NORTH-WESTERN CENTRE.—The report of the Committee for the 1926-27 session shows that 10 meetings were held during the session, with an average attendance of 112, in addition to the Faraday Lecture and the annual dinner. At the annual general meeting the following officials and new committee men were elected for the 1927-28 session:—*Chairman*, Mr. A. B. Mallinson; *vice-chairmen*, Messrs. W. J. H. Wood and T. E. Herbert; *hon. secretary*, Mr. J. D. Peattie; *committee*, Messrs. H. Hawkins, A. L. Lunn, O. Howarth, H. Cobden Turner, and G. A. Juhlin; *hon. treasurer of benevolent fund*, Mr. A. S. Barnard. The officials for the Students' Section for the new session include: *Chairman*, Mr. G. R. Millward; *vice-chairman*, Mr. W. L. England; *hon. secretary*, Mr. H. W. Hardern.

COUNCIL'S NOMINATIONS.—The Council's nominations for election to the Council to fill the vacancies which will occur on September 30th, 1927, are as follows:—*President*: Mr. A. Page; *vice-president*: Capt. J. M. Donaldson; *hon. treasurer*: Lieut.-Col. F. A. Cortez Leigh; *members of Council*: Major B. Binyon, Messrs. J. R. Beard, P. V. Hunter, H. Marryat, H. T. Young, and D. N. Dunlop.

Institution of Heating and Ventilating Engineers.

The Institution is holding its Summer Meetings on June 20th, 21st, and 22nd at Bournemouth.

Association of Mining Electrical Engineers.

The annual meeting was held held last week at Harrogate, Mr. D. Martin (Glasgow) presiding. The membership was reported to be 2,023. In his presidential address, Mr. G. M. Harvey (Birmingham) said that it was now universally acknowledged in the mining world that the increased application of electricity was the key by which they could attain greater production, thus enabling them to meet foreign competition without reducing wages. He suggested for consideration the possibility of adapting American methods, where practicable, in order to increase output. The Association's gold medal was awarded to Major E. I. David for a paper on "Protection of a.c. Systems Against Short Circuits." Messrs. F. Anslow (Glasgow) and J. C. Crawshaw (Dewsbury) were elected vice-presidents.

North-East Coast Institution of Engineers and Shipbuilders.

SUMMER MEETING.—The Institution will hold a summer meeting in Glasgow jointly with the Institution of Engineers and Shipbuilders in Scotland from June 20th to 23rd inclusive. The programme includes the reading and discussion of papers, visits to electrical and other works, and excursions specially arranged for ladies.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements

Birthday Honours.

In this year's list of Birthday Honours, which was published on Friday last, the great distinction of Order of Merit was conferred upon Sir CHAS. PARSONS, F.R.S., and Sir HARRY RENWICK received the honour of a Baronetcy. To these we refer in our leaderettes to-day. Other honours in the list are as follows:—Sir H. F. HEATH, K.C.B., late Secretary to the Department of Scientific and Industrial Research, and Sir RICHARD THRELFALL, K.B.E., F.R.S., receive the distinction of G.B.E.; Lt.-Col. G. W. HUMPHREYS, C.B.E., Chief Engineer to the London County Council, is made a K.B.E.; Mr. H. SPARKES, O.B.E., Controller of Stores, G.P.O., receives the C.B.E.; Lt.-Col. A. G. LEE, M.C., M.I.E.E., Staff Engineer, G.P.O., Mr. V. E. PULLIN, Director of Radiological Research, War Office, and Major J. J. MUNRO, Deputy Inspector-General of Telegraphs, Egyptian Government, receive the O.B.E.; and Mr. C. H. KLYNE, Assistant Electrical Engineer, Admiralty, Mr. H. M. JOHNSON, Assistant Telegraph Engineer, Sudan Telegraphs, and Mr. R. MOFFATT, Assistant Engineer, Posts and Telegraphs Department, Palestine, become M.B.E.

We reproduce herewith a portrait of Mr. W. J. H. WOOD, who, as reported in our last issue, has been appointed engineer-in-chief to the County of London Electric Supply Co., Ltd. Mr. Wood received his early training at the Crystal Palace School of Practical Engineering, at the Phœnix Works, Antwerp, and with the Cie. Hydro-Electrique, Antwerp. He entered municipal electrical service as a junior engineer with the Edinburgh Corporation, and two years later went to Bolton as assistant engineer, being appointed engineer and manager in 1913. Mr. Wood was appointed chairman of the Engineering Committee of the South-East Lancs. Electricity Advisory Board in 1925, when Dr. S. L. Pearce resigned the position upon becoming an Electricity Commissioner. Since the formation of the North-Western Area District Industrial Council and the District Joint Board for the electricity supply industry, in 1919, Mr. Wood has represented a group of the largest undertakers. He is a member of the Institutions of Electrical and Mechanical Engineers, and of the Textile Institute. He

Mr. W. J. H. Wood,
Engineer-in-Chief to the County of London Electric Supply Co.

is senior vice-chairman of the North-Western Centre of the I.E.E., and a member of the Council of the Incorporated Municipal Electrical Association. As electrical engineer of Bolton he was directly and solely responsible for the design and construction of the Back-o'-th'-Bank generating station, and since his appointment the annual output of the undertaking has increased by about 46 million kWh.

The *Manchester Guardian* states that Mr. JOHN LEE will retire from the controllership of the Central Telegraph Office this month. He was attached to the Secretary's office, London; in 1917 became Postmaster of Belfast, and in due course controller of the C.T.O., London. "Mr. Lee has done much to develop Whitleyism in the Civil Service."

The second Mascart medal has been awarded to Prof. Sir J. J. THOMSON, F.R.S., by the Société Française des Electriciens, and was presented at the Sorbonne on Friday last. The medal, which commemorates the famous French physicist, is awarded once in three years; the previous award was to M. André Blondel.

Sir DONALD MACALISTER, Bt., and Sir OTTO BEIT, K.C.M.G., have been reappointed as members of the Governing Body of the Imperial College of Science and Technology for a further term of four years, and Lord RAYLEIGH, F.R.S., is appointed to be a member for a similar period.

Sir R. T. GLAZEBROOK, F.R.S., has been appointed a member of the Advisory Council to the Committee of the Privy Council for Scientific and Industrial Research.

MR. W. TYSON, who has been a member of the research staff of the Standard Telephones and Cables, Ltd., of Woolwich, has been appointed agent and consultant for Great Britain for the Société Industriale de Téléphones, of Paris.

The Bromley (Kent) Town Council has decided to appoint Mr. W. G. TREND as borough electrical engineer for one year as from April 1st last, at an inclusive salary of £750 a year.

MR. J. J. O'HORAN, one of the mains engineers of the Calcutta Electric Supply Corporation, Ltd., has resigned his post after seven years' service with the company to take up an appointment on the engineering staff of a large motor-cycle manufacturing concern in this country.

MR. HENRY REGINALD WILLIAMS, managing director of Messrs. Lindsay & Williams, Ltd., Manchester, was married at Chapel Allerton, Leeds, on June 1st to Miss MARY ELLEN COGGAN, of Sheffield.

MR. C. W. EVE, sales promotion manager, Standard Telephones and Cables, Ltd., has been elected chairman of the Incorporated Society of British Advertisers.

At the annual meeting of the Ayrshire Electricity Board, ex-Provost MATTHEW SMITH was unanimously reappointed chairman and Sir ALEXANDER WALKER vice-chairman. Police Judge ANDREW HUNTER and ex-Bailie DAVID JONES were re-elected as conveners of the Finance and Engineering Committees respectively.

County Alderman T. E. HIGHAM, of Accrington, chairman of the Mid-Lancashire Electricity Board, and chairman of Accrington Electricity Committee, has been selected as the jubilee Mayor of Accrington.

Will.—The late Mr. ALBERT GAY left £1,599 net and £2,184 gross personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Irish Radio Stockists, Ltd.—Private company. Registered in Dublin, May 26th. Capital, £1,000 in £1 shares. Objects: To acquire the business now carried on by the Irish Radio Stockists, and to carry on the business of dealers in wireless apparatus, &c. The subscribers (each with one share) are:—H. J. Farrell, 131, Emmet Road, Inchicore, Dublin, manufacturer's agent; J. Matthew, 99, Botanic Road, Dublin, clerk; H. J. Shirley, 55, Rose Mount Terrace, Kilmainham, Dublin, shop assistant; W. J. Byrne, 5, Lower Buckingham Street, Dublin, radio engineer. The first directors are not named.

British Curtis Radio, Ltd.—Private company. Registered May 28th. Capital, £2,500 in £1 shares. Objects: To acquire the business of manufacturers and merchants of wireless and telephonic apparatus now carried on by Peter Curtis, Ltd., at 11, Red Lion Square, W.C., and elsewhere. The first directors are:—A. E. Blackwell, "Dunromin," Dalmeny Lane, Carshalton, Surrey (director of the Vulcan Chemical Co., Ltd.); G. W. Croot, "Balmoral," Ashton Gardens, Chadwell Heath, Essex. Qualification, £1.

Artandia, Ltd.—Private company. Registered May 28th. Capital, £26,250 in 25,000 ordinary shares of £1 each and 25,000 "B" shares of 1s. each. Objects: To adopt an agreement with Don Gabriel Gonzalez de Andia-Yrarrazaval, of 24, Park Lane, Mayfair, W., providing for the purchase of certain inventions, patent rights, and registered designs in relation to sound reproducing and amplifying apparatus, and provision of certain services, and to carry on the business of manufacturers of and dealers in apparatus, instruments, &c. The first directors are:—Marquis Gabriel Gonzalez de Andia-Yrarrazaval, 24, Park Lane, W.1 (permanent); Rt. Hon. Baron Ridesdale, 26, Rutland Gate, S.W.7; Col. J. C. Brinton, C.V.O., D.S.O., Badminton, Glos. (nominee of Marquis Andia-Yrarrazaval); G. T. Bowles, 2, Ryder Street, St. James, S.W.1. Remuneration: 10 per cent. of the net profits divided between them. Solicitors: Hasties, 65, Lincoln's Inn Fields, W.C.2. Registered office: 38, Bedford Street, Strand, W.C.2.

Sifam Electrical Instrument Co., Ltd.—Private company. Registered June 1st. Capital, £1,000 in £1 shares. Objects: To acquire and carry on in the U.K., the Irish Free State, and British Colonies and Dependencies, the business hitherto carried on by La Société Industrielle pour la Fabrication d'Appareils de Mesure (a company incorporated in France), and to carry on the business of manufacturers, importers and exporters of and dealers in all kinds of electrical measuring apparatus, switchboard control instruments, &c. The subscribers (each with 2 shares) are:—J. P. McKenzie, 21, Leyland Road, Lee, S.E.12, engineer; A. J. Wheatland, 110, Dalzell Road, Brixton, S.W.9, solicitor's clerk. The subscribers are to appoint the first directors. So long as La Société Industrielle pour la Fabrication d'Appareils de Mesure holds £500 shares, it may have two representatives on the directorate. No share qualification required. Solicitors: Bulcraig & Davis, Amberley House, Norfolk Street, W.C.

Herne Bay and District Electricity Supply Co., Ltd.—Public company. Registered May 31st. Capital, £70,000 in £1 shares (50,000 ordinary and 20,000 deferred). The objects are to acquire a transfer from A. J. Hunt, A. W. Hunt, A. G. Hunt, Daisy E. Hunt, and Emmie Hunt, or other parties entitled thereto, of the Herne Bay and District Electricity Special Order, 1926, and the undertaking authorised by such Order, for £315 cash, to develop and turn to account the undertaking, and to carry on the business of electricians, mechanical engineers, manufacturers and workers of and dealers in electricity, motive power and light, &c. The minimum cash subscription is 7 shares. The first directors (to number not less than 4 nor more than 9) are:—Sir Thomas O. Callender, J.P., Bidborough Court, near Tunbridge Wells (managing director of Callender's Cable & Construction Co., Ltd.); P. V. Hunter, C.B.E., Springhurst, Addington (assistant manager of Callender's Cable & Construction Co., Ltd.); A. J. Hunt, 65, Mortimer Street, Herne Bay, engineer; Daisy E. Hunt, 65, Mortimer Street, Herne Bay, engineer (secretary of Hunt and Sons). Qualification: £500 shares or stock. Remuneration (except managing director) £100 each per annum (chairman £150), and a sum equal to 5 per cent. of the net profits in each year when a dividend of not less than 6 per cent. is paid on the ordinary and deferred shares, divided between them. Secretary: H. Foulds. Solicitors: Drake, Son & Parton, 24, Rood Lane, E.C.3. The registered office is at Hamilton House, Victoria Embankment, E.C.4.

Radio Electric Co. (Bournemouth), Ltd.—Private company. Registered June 2nd. Capital, £1,000 in £1 shares (250 7½ per cent. cumulative preference and 750 ordinary). Objects: To carry on the business of radio engineers (wireless), including television, and any other invention in connection with radiology. The first directors are:—Major A. G. Smith, 10, Rushton Crescent, Bournemouth; M. C. Barber, "Burwood," New Milton, gentleman; Miss Marion R. Smith, 10, Rushton Crescent, Bournemouth; S. H. Pearce, 24, Derby Road, Bournemouth, commercial tutor (all permanent). Qualification: £100. Secretary: M. R. Smith. Solicitors: J. and W. H. Devitt, Bournemouth.

R. J. Sinclair & Co. (Glasgow), Ltd.—Private company. Registered in Edinburgh, May 27th. Capital, £500 in £1 shares. Objects: To carry on the business of electrical engineers and contractors, &c. The directors are:—J. Sinclair, 96, Camphill Avenue, Langside, Glasgow, accountant; G. Dalrymple, 80, Bellgrove Street, Dennistoun, Glasgow, cabinet maker. Qualification: £10 shares. Secretary: J. Sinclair. Registered office: 178a, Bath Street, Glasgow.

Electric Repairs (Glasgow), Ltd.—Private company. Registered in Edinburgh, June 2nd. Capital, £500 in £1 shares. Objects: To carry on the business of electricians, mechanical engineers, &c. The first directors are:—A. M. Maclachlan, 1, Woodburn Place, Glasgow, electrical engineer; Kate Maclachlan, 1, Woodburn Place, Glasgow; H. G. Allday, 15a, Edenhurst Road, Mile End, Stockport, mantle merchant. Registered office: 105, Bothwell Street, Glasgow.

Official Returns of Electrical Companies.

County of London Electric Supply Co., Ltd.—A trust deed has been registered, dated May 19th, 1927, to secure £4,250,000 5 per cent. debenture stock (with power to issue further debenture stock from time to time, by supplemental trust deeds, but the aggregate amount of stock secured is not at any time to exceed the total amount paid up in cash in respect of the company's share capital, plus any amounts standing to the credit of the company's reserves and of sinking funds provided under the London Electricity (No. 1) Act, 1925). Property charged: The company's undertaking and property, present and future, including uncalled capital, coupled with a covenant by the company that it will not, without the previous sanction of an extraordinary resolution of the stock-

holders, create any mortgage or charge on any of its assets ranking in priority to or *pari passu* with the charge created by the above deed, except only charges (whether specific or floating) for securing temporary loans raised by the company in the ordinary course of business up to a total not at any time exceeding 10 per cent. of the nominal amount of the aggregate stock and of any additional stock ranking *pari passu* therewith in point of charge from time to time outstanding. The trustees are: The Electric and General Investment Co., Ltd., of Falcon House, Aldersgate Street, E.C.1; and the Law Debenture Corporation, Ltd., of 24, Old Broad Street, E.C.2. The stock was issued at 96 per cent., and the company paid to Messrs. W. Greenwell & Co. and Messrs. Foster and Braithwaite an underwriting commission of 1¼ per cent., and an overriding commission of ¼ per cent. on the nominal value of the stock.

Siderman Electrical Supplies, Ltd.—Debenture dated May 9th, 1927, to secure £500, charged on the company's property, present and future, including uncalled capital. Holder: A. Siderman, 51, Cleveland Street, Fitzroy Square, W.1.

British Resistor Co., Ltd.—Capital, £1,000 in £1 shares. Return dated January 28th, 1926 (filed April 13th, 1927). All shares taken up. £1,000 paid. Mortgages and charges, nil.

Valco, Ltd.—Capital, £100 in £1 shares. Return dated December 31st, 1926 (filed April 1st, 1927) Two shares taken up. £2 paid. Mortgages and charges, nil.

Darimont Electric Batteries, Ltd.—Capital, £18,000 in 62,000 ordinary shares of 5s. each, and 50,000 deferred shares of 1s. each. Return dated December 28th, 1926. All shares taken up. £8,999 16s. paid on 34,666 ordinary and 6,666 deferred shares. £9,000 4s. considered as paid on 27,334 ordinary and 43,334 deferred shares. Mortgages and charges, nil.

Gas and Electricity Development Co., Ltd.—Capital, £2,000 in £1 shares. Return dated December 31st, 1926 (filed March 22nd, 1927). All shares taken up. £2,000 paid. Mortgages and charges, nil.

Adelaide Electric Supply Co., Ltd.—Capital, £2,250,000 in 500,000 ordinary, 1,250,000 preference and 500,000 preferred ordinary shares of £1 each. Return dated November 24th, 1926 (filed February 9th, 1927). All shares taken up. £2,120,000 paid on 370,000 ordinary, 1,250,000 preference, and 500,000 preferred ordinary shares. £130,000 considered as paid on 130,000 ordinary shares. Mortgages and charges: £1,073,217.

Vee Cee Dry Cell Co., Ltd.—Capital, £5,000 in £1 shares. Return dated October 17th, 1926 (filed May 2nd, 1927). 1,450 shares taken up. £1,200 paid, £250 considered as paid. Mortgages and charges, £1,000.

Electric Cables, Ltd.—Capital, £2,000 in £1 shares. Return dated December 31st, 1926 (filed March 22nd, 1927). £1,000 shares taken up. £1,000 paid. Mortgages and charges, nil.

Johnson, Ross & Co., Ltd.—Particulars filed of £1,000 debentures dated May 9th, 1927, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £500.

James Keith & Blackman Co., Ltd.—Satisfaction in full on May 14th, 1927, of debentures dated June 12th, 1914, and May 9th, 1922, securing £775.

J. Brent & Co., Ltd.—Capital, £1,000 in £1 shares. Return dated November 30th (filed December 14th), 1926. 776 shares taken up. £576 paid. £200 considered as paid. Mortgages and charges, nil.

Turner, Atherton & Co., Ltd.—Capital, £140,116 in 62,861 preference and 77,255 ordinary shares of £1 each. Return dated August 17th, 1926 (filed January 21st, 1927). 49,172 preference and 51,597 ordinary shares taken up. £26,487 paid on 7,259 ordinary and 19,228 preference shares. £74,282 considered as paid on the remainder. Mortgages and charges, nil.

Milldale, Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1926 (filed April 6th, 1927). 740 shares taken up. £740 paid. Mortgages and charges, nil.

Forest City Electric Co., Ltd.—Capital, £5,000 in £1 shares. Return dated February 25th, 1927. 2,642 shares taken up. £2,202 paid. £440 considered as paid. Mortgages and charges, nil.

Mexican Hydro-Electric Development Syndicate, Ltd.—Capital, £26,000 in £1 shares. Return dated October 14th (filed December 28th), 1926. 25,350 shares taken up. £7,450 paid. £17,900 considered as paid. Mortgages and charges, nil.

Sydney W. Bussell, Ltd.—Mortgage or charge on the company's undertaking and property, present and future, including uncalled capital, dated May 24th, 1927, to secure £850. Holders: Pedestros, Ltd., 26, Langham Street, W.

I. D. Morison, Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1926 (filed January 21st, 1927). 500 shares taken up and fully paid. Mortgages and charges, nil.

Bestolamps, Ltd.—Capital, £3,000 in 2,500 preference shares of £1 each and 10,000 ordinary shares of 1s. each. Return dated December 31st, 1926 (filed April 2nd, 1927). 1,300 preference and 10,000 ordinary shares taken up. £500 paid on 500 preference shares. £1,300 considered as paid on 800 preference and 10,000 ordinary shares. Mortgages and charges, nil.

Wheatley, Smith & Co., Ltd.—Debenture dated May 18th, 1927, to secure £300, charged on the company's undertaking or property, present and future, including uncalled share capital. Holders: J. J. Eastick & Sons, Eelex House, Bunhill Row, E.C.

Jersey Electric Lighting and Power Co., Ltd.—Particulars filed of £15,000 debentures authorised May 5th, 1927, charged on the company's undertaking and property, including uncalled capital, the amount of the present issue being £12,000.

Abies Battery Co., Ltd.—Capital, £2,000 in £1 shares. Return dated August 14th, 1926 (filed April 21st, 1927). 878 shares taken up. £378 paid. £500 considered as paid. Mortgages and charges, nil.

Electrical Contracts and Maintenance Co. (1925), Ltd.—Capital, £3,000 in £1 shares. Return dated March 23rd, 1927. 2,075 shares taken up. £2,075 paid. Mortgages and charges, £250.

Quality Radio, Ltd.—Capital £100 in £1 shares. Return dated December 31st, 1926 (filed March 24th, 1927). 76 shares taken up. £76 paid. Mortgages and charges, nil.

W. Skewes & Co., Ltd.—Capital, £1,000 in £1 shares. Return dated March 23rd, 1927. All shares taken up. £650 paid. £350 considered as paid. Mortgages and charges, nil.

Artic Fuse and Electrical Manufacturing Co., Ltd.—Capital, £5,000 in 4,700 ordinary and 100 deferred ordinary shares of £1 each and 4,000 founders' shares of 1s. each. Return dated December 31st, 1926 (filled March 1st, 1927). 2,433 ordinary, 100 deferred ordinary, and 1,933 founders' shares taken up. £2,079 13s. paid on 1,983 ordinary and 1,933 founders' shares. £550 considered as paid on 450 ordinary and 100 deferred ordinary shares. Mortgages and charges, nil.

Wickford and District Electricity Supply Co., Ltd.—Capital, £5,000 in £1 shares. Return dated December 31st, 1926 (filed February 4th, 1927). 2,206 shares taken up. £2,206 paid. Mortgages and charges, nil.

Kinetic Elutriators, Ltd.—Capital, £500 in 1s. shares. Return dated December 31st, 1926 (filed March 29th, 1927). All shares taken up. £100 paid. £400 considered as paid. Mortgages and charges, nil.

H. W. Dutton & Co., Ltd.—Capital, £2,000 in £1 shares. Return dated December 31st, 1926 (filed April 9th, 1927). All shares taken up. £1,415 paid, being £1 per share on 50 shares and 14s. per share on 1,950 shares. Mortgages and charges, nil.

Harrison Brothers (Electrical Engineers), Ltd.—J. H. Anderson, C.A., of Zetland Road, Middlesbrough, was appointed receiver on May 20th, 1927, under powers contained in debenture dated June 22nd, 1926.

C. J. Thursfield & Co., Ltd.—Second charge on the company's undertaking and property, present and future, including uncalled capital, book debts, and unpaid calls, dated May 13th, 1927, to secure all moneys for which the mortgagees (R. C. S. Jansie, 106, Trafalgar Road, Moseley, and two others) may become liable under a guarantee to company's bankers.

Airedale Electrical and Manufacturing Co., Ltd.—Equitable mortgage on freehold property No. 392, Bowling Old Lane, Bradford, dated May 11th, 1927, to secure all moneys due or to become due from the company to Bank of Liverpool and Martins, Ltd., not exceeding £700. This security is in addition to debentures granted to the above bank on November 28th, 1923.

Yarmouth (I.W.) Electricity Supply Co., Ltd.—Capital, £5,000 in £5 shares. Return dated March 21st, 1927. 361 shares taken up. £1,805 paid. Mortgages and charges, nil.

Gent & Co., Ltd.—Capital, £50,000 in 20,000 preference and 30,000 ordinary shares of £1 each. Return dated March 15th, 1927. 4,427 preference and 20,876 ordinary shares taken up. £6,887 paid on 957 preference and 5,930 ordinary shares. £18,416 considered as paid on 3,470 preference and 14,946 ordinary shares. Mortgages and charges, £16,500.

Wellingborough Electric Supply Co., Ltd.—Capital, £50,000 in £10 shares. Return dated March 9th, 1927. 4,500 shares taken up. £45,000 paid. Mortgages and charges, £17,500.

Smithfield Markets Electric Supply Co., Ltd.—Capital, £100,000 in 60,000 ordinary shares of £1 each and 8,000 ordinary shares of £5 each. Return dated March 9th, 1927. 60,000 £1 ordinary shares taken up. £60,000 paid. Mortgages and charges, £13,040.

City Notes.

Shanghai Electric Construction Co., Ltd.

The annual meeting of this company, whose report was dealt with in our issue of May 27th, p. 852, was held on June 1st. Mr. J. S. Haskell, the chairman, in the course of his speech, said that comparison of the past year's results with those of 1925 were of no value owing to the abnormal conditions prevailing in the latter year. Against 1924, however, there was a net improvement of £11,024 in the operating profit. The increase in the operating expenses was out of proportion to the growth of traffic, because there had been a general tendency towards higher wages and prices of supplies. The participation in the Singapore Traction Co., Ltd., made the substantial addition of £10,000 to their earnings. Although the profits would have justified a higher dividend, it was thought prudent to restrict it to 10 per cent. on account of the unprecedented conditions in Shanghai, coupled with a bank overdraft of £82,000. The time was not appropriate for a new issue to repay the bank, but the necessity for it, at the proper time, was realised. The company's business had been gravely handicapped by recent events in Shanghai, but he (the chairman) was glad to say that there had been an improvement lately, and with the advent of more settled conditions the company had been able to augment its services to bring them nearer the normal level. In view of the conditions, an application was made to the Municipal Council for a revision of tariffs. That was granted, and the new fares were put into force on May 1st and were understood to be satisfactory. Referring to the Singapore Traction Co., Ltd., Mr. Maskell said that the first year's results were good. The replacement of the trams by trolley 'buses was expected to be completed in the spring of next year. Since the end of March there had been a falling-off in receipts owing to a boycott by the Chinese. Upon the whole, conditions were not so unfavourable as they might have been, and although they were by no means free from anxiety, there were indications of a general improvement.

Madras Electric Supply Corporation, Ltd.

This company's report was reviewed in our issue of May 27th (p. 852). The annual meeting was held on May 30th, when the chairman (Mr. James Gray), in the course of his speech, said that the improvement in the sales of energy (7 per cent.) was considered satisfactory. The necessary equipment for the supply of energy to the workshops of the Madras and Southern Mahratta Railway had arrived, and the supply should be available during the latter half of the year. Negotiations were being conducted with another railway company for the supply of power in connection with the proposed electrification of the system. The first of the new 6,000-kW sets was put into commission in January, and the erection of the second was proceeding. The first 40,000-lb. boiler was put into operation in July last; a second was approaching completion and two others were to follow. During the year the capital was increased to £800,000 by the issue to shareholders of 110,000 ordinary £1 shares at 25s. 6d. each.

Dealing with the Madras Electric Tramways, the chairman said that only the preference dividend was paid for 1926. There had been no material change in the position, although there were indications that the opposition was relaxing. The management had granted various privileges to passengers to attract traffic back to the tramways; they were confident that in the end the tramways would come into their own again. The report and accounts were adopted.

Oriental Telephone and Electric Co., Ltd.

The annual meeting was held on June 3rd, Sir A. H. McMahon, G.C.M.G. (chairman) presiding. In moving the adoption of the report and accounts (which were dealt with in our last issue, p. 896), the chairman said that in view of the conditions the results of the past year's working were satisfactory. There was good reason for anticipating steadily-improving results as normal trade conditions returned. The available balance showed an increase. Of the two branches directly worked by the company that at Singapore had done very well, the gross revenue increasing by over £11,000; it had become necessary to consider the provision of additional equipment to meet the anticipated growth. The Mauritius branch unfortunately showed no signs of returning animation. The company was handicapped by its obligation to provide communication between the central exchange at Port Louis and exchanges in other parts of the island which had developed beyond expectation. Repeated application had been made to the Government for sanction to increase the rates, but this had not so far been granted. In addition, Mauritius had been passing through a period of depression. There were, however, some indications of improvement. After dealing with the operations of the subsidiary companies, the chairman mentioned the institution of a staff provident fund and the appointment to the board of Sir Thomas Catto in succession to Mr. G. Parker Ness, who had resigned.

Rangoon Electric Tramway and Supply Co., Ltd.

The annual meeting of this company was held on May 30th. Mr. P. Henstock (chairman), who presided, referred to the deaths of Mr. F. Tobin and Sir J. Harmood-Banner, who had been connected with the company. Turning to the report (*vide* ELEC. REV., April 29th, p. 691), Mr. Henstock said that the shareholders fully subscribed an issue of 100,000 ordinary shares, at Rs. 16 per share, which was made during the year. The year's capital expenditure amounted to £105,003, of which over £85,500 was incurred in the power-house plant and the cable system, including sub-stations. With the estimated expenditure of 15 lakhs during the current year, the total capital expenditure would reach £746,666. The scheme for modernising the Ahlone power house was nearly finished. The last set put in, which would shortly be ready for trials, brought the capacity of the station up to 16,500 kW. As a result of modernisation, in spite of higher fuel costs, the cost per kWh had been lowered. The economies effected had enabled them to make a reduction of about 9 per cent. in the charges. The same policy of modernisation was being extended to the boiler plant. They had had to spend Rs. 11 lakhs in connection with the supply of condensing water, which had made an appreciable addition to the production costs. The main tramway depôt was being constructed and brought up to date. The rate of increase in traffic had not been maintained, owing mainly to the exceptional floods which kept visitors away, and to motor-'bus competition. The company was running 'buses experimentally, and the services would be extended when the vehicles were received. To counteract the overloading of the mains, the pressure of supply was to be raised. In conclusion, the chairman said that the company proposed to contribute Rs. 15,000 towards the Rangoon University Endowment Fund.

Cawnpore Electric Supply Corporation, Ltd.

Mr. J. G. B. Stone (chairman) presided at the annual meeting on May 30th, and in moving the adoption of the report (ELEC. REV., May 27th, p. 852), said that there was a growing demand for industrial supply, and the sales of energy had risen by 18 per cent. Bulk supply consumers had benefited from a considerable reduction in the price of coal. The experimental 'bus services had proved unremunerative and were being discontinued; it was found that their object—to act as feeders to the trams—was not being fulfilled. The sales department, which made a profit of £865 in 1925, incurred a loss of £70 during last year. That department, in addition to carrying out installation contracts, was employed generally in the work of assisting and advising existing consumers, and in obtaining new ones. Owing to industrial depression, a large proportion of the plant lay idle for some time, but towards the end of the year there was an increased demand. The maximum demand had reached 6,708 kW, which was about half of the capacity of the Riverside Station, allowing for spare plant. At the end of April the demand was 33 per cent. more than at the corresponding date of last year, and further improvement was anticipated.

British Electric Traction Co., Ltd.

The gross profit for the year ended March 31st last amounted to £301,044, as against £300,544 in 1925-26, and after deducting general expenses, loan, interest, &c., there is a balance of £173,008. A dividend of 8 per cent. is declared on the ordinary stock, as for last year, leaving a surplus of £24,143. The directors recommend that a further non-cumulative dividend of 2 per cent. be paid on the preference stock (making 8 per cent. for the year), which will require £14,255, leaving a balance of £9,888 to be added to undivided profits account, making that account £304,378. The directors further recommend that £132,626, equal to 10 per cent. on the ordinary stock, be distributed out of undivided profits account to the ordinary stockholders in fully-paid deferred ordinary stock. It is also proposed to convert the ordinary stock into an equal amount of 8 per cent. non-cumulative preferred ordinary stock, ranking for dividend as from April 1st, 1927, and having priority both as to capital and dividend over the deferred ordinary stock. The amount standing to the credit of reserve account is £520,000. Meeting: June 21st.

North of Scotland Electric Light and Power Co., Ltd.

The report for 1926 states that during the year the Inverness Town Council completed the purchase of the local undertaking. The balance of general reserve account brought forward, together with the sums available for application to the Inverness undertaking, enabled the company to distribute a bonus of £71,250 to the shareholders. After providing for interest, preference dividend, &c., there remained a balance of £6,845. The total ordinary dividend is 7 per cent., free of tax; £3,000 has been transferred to renewal reserve account; and £345 is carried forward. Mr. F. E. Gripper has resigned from the board owing to ill-health; his place has been taken by Mr. C. H. Jones.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.

The profit for the year ended December 31st last was £25,899, as compared with £22,138 for 1925. After providing for interest and depreciation and placing £3,000 to reserve and adding the balance brought forward, there remains £3,978. It is proposed to pay a dividend of 6 per cent. on the ordinary shares, leaving £978 to be carried forward. The meeting was to be held yesterday (Thursday).

Ever-Ready Co. (Great Britain), Ltd.

The annual meeting was held on May 31st, Mr. C. H. C. Moller (chairman) presiding. In presenting the report (ELEC. REV., May 13th, p. 770), the chairman said that, in spite of the adverse conditions, they had had a successful year. They were able to market their goods at prices with which small manufacturers were unable to compete. Every step was taken to improve production methods and reduce costs while maintaining quality. The properties, plant, machinery, &c., appeared in the accounts at a low figure, this being based upon pre-war values. The reserve now stood at £170,000, and the reserve for contingencies at £15,000. The contribution of £5,000 to a staff benevolent fund was a new item; the fund would enable the pensioning of employés to be dealt with in a systematic manner. Their Government securities now totalled £245,000; it might be necessary to realise some of these during the year to provide for expansion of the business.

Stock Exchange Notices.

The Committee has ordered the following to be officially quoted :—

Calcutta Electric Supply Corporation, Ltd.—136,671 ordinary shares of £1 each, fully paid, Nos. 1,366,711 to 1,503,381.

Shropshire, Worcestershire and Staffordshire Electric Power Co.—250,000 "A" ordinary shares of £1 each, fully paid, Nos. 860,001 to 1,110,000, and 150,000 "B" ordinary shares of £1 each, fully paid, Nos. 650,001 to 800,000.

Llanelly and District Electric Supply.—£279,581 5 per cent. first mortgage debenture stock.

North Metropolitan Electric Power Supply.—850,000 ordinary shares of £1 each, fully paid, Nos. 1 to 850,000.

Dealings in the following have been specially allowed by the Committee under Rule 159 :—

International Telephone and Telegraph Corporation.—$36,040,700 capital stock in shares of $100 each.

Metropolitan District Railway.—£250,000 new five per cent. redeemable debenture stock, 1933-43.

Electric Construction Co., Ltd.

The report for the year ended March 31st last records a net profit of £19,703, after providing for debenture interest and depreciation. To this is added £21,537 brought forward, making £41,240. It is proposed to pay a final ordinary dividend at the rate of 9 per cent. per annum, making 7½ per cent. for the year, as against 10 per cent. for 1925-26, when the net profit was £37,520. A balance of £14,345 is carried forward. Severe competition both in home and overseas markets was experienced during the year. This was intensified by the prolonged coal dispute, which was also responsible for an increase in production costs. The meeting was to be held yesterday (Thursday).

Bromley (Kent) Electric Light and Power Co., Ltd.

The report for the year ended December 31st last states that the outstanding debentures have now been redeemed. During the latter part of last year negotiations were entered into with the Bromley Town Council for a settlement of the purchase price for the undertaking and since the end of the year an agreement has been reached. After the payment of debenture interest, &c., the profit for the year was £27,491. To this is added £11,108 brought forward, making £38,599. It is proposed to pay a dividend of 10 per cent., free of tax, and to carry forward a balance of £29,599. Meeting: June 13th.

Ruston & Hornsby, Ltd.

The profit for the year ended March 31st last was £89,196, and after providing for debenture interest and depreciation and adding £28,307 brought forward, there remains £49,310. A year's dividend is to be paid on the 5 and 6 per cent. preference shares, and a balance of £25,810 is carried forward. The directors state that the improvement of the previous year was not maintained, and they are therefore unable to recommend a dividend on the ordinary shares. For 1925-26 a dividend of 2½ per cent. was paid.

Callender's Cable and Construction Co., Ltd.

The accounts for 1926, subject to final audit, show a profit of £356,590 against £368,643 in 1925. From this it is proposed to pay a total dividend for the year of 15 per cent. (3s. per share) on the old and new ordinary shares, of which 1s. per share has already been paid. The previous year's dividend on the old ordinary shares was 15 per cent.

Lima Light, Power and Tramways Co.

The report for 1926 shows a net profit of £P.114,477, and the addition of £P.12,912 brought forward, makes available £P.127,389. After providing for bond amortisation and preference share dividends, a balance of £P.11,158 is carried forward.

Stanton Ironworks Co., Ltd.

The final dividend on the ordinary shares is 6 per cent., free of tax, making 10 per cent., free of tax, for the year, as for 1925.

Anderston Foundry Co., Ltd.

A dividend of 6¼ per cent. has been declared out of a net profit of £7,894 for 1926-27.

Fellows Magneto Co., Ltd.

There was a net profit of £10,827 for 1926, but the aggregate debit balance at the end of the year was £253,000. In view of this and the necessity for working capital it has been decided to form a new company with the title "Fellows Manufacturing Co., Ltd." This company will have a capital of £175,000, and shareholders of the existing company will receive, if they elect to do so, a 10s. preferred ordinary share with 7s. credited paid for every preference share and one deferred 2s. 6d. ordinary share with 6d. credited paid for every ordinary share. The calls for the further amounts will be spread over four months. Meeting: June 15th.

Telephone Manufacturing Co., Ltd.

The accounts for 1926 show a net profit of £5,426, as compared with a loss of £21,212 for 1925. It is proposed to devote £4,094 of the profit and £23,275 from a special reserve to writing down the expenses of the new issue, the balance of profit being carried forward. The benefit of contracts delayed by the general strike will be felt during the current year. It is stated that the capital now consists entirely of ordinary shares and the whole of the assets are free from all charges.

Sir W. G. Armstrong, Whitworth & Co., Ltd.

It was reported on the Stock Exchange last week (says the *Financial Times*) that the International Paper Company (a New York concern) had made an offer for the Newfoundland interests of the company.

Reduction of Capital.

MARCONI'S WIRELESS TELEGRAPH CO., LTD., AND REDUCED.—A petition has been presented to the High Court for the confirmation of the reduction of the capital of the company from £4,000,000 to £2,374,954, and will be heard in London on June 14th.

Mirrlees, Bickerton & Day, Ltd.

A dividend of 6 per cent. has been declared on the ordinary shares. Last year the shareholders received 12½ per cent. under the amalgamation agreement with the Mirrlees-Watson Co.

Quebec Power Co.

A dividend of $1½ per share has been declared on the common shares for the quarter ending June 30th. It is proposed to convert each $100 common share into four shares of no par value.

Guest, Keen & Nettlefolds, Ltd.

A final dividend of 1s. per share is recommended on the ordinary shares, making 10 per cent., free of tax, for the year, as for a number of years past.

Aron Electricity Meter, Ltd.

The directors recommend a dividend of 6 per cent. upon the ordinary shares in respect of the year ended March 31st last. The 1925-26 dividend was the same.

Northern Mexico Power and Development Co.

Dividends of 1¾ per cent. and 1 per cent. respectively have been declared on the preference and common stocks in respect of the current quarter.

Shawinigan Water and Power Co.

A dividend of $0.5 per common share has been declared in respect of the quarter ending June 30th.

O. C. Hawkes, Ltd.

An interim dividend of 6 per cent. per annum, free of tax, has been declared on the ordinary shares.

Stocks and Shares.

TUESDAY EVENING.

STOCK Exchange business suffered interference through the Whitsun holidays occurring in the long "account" that tempts men to remain away from town when the circumstances permit. There is not a great deal to engage business energy in Stock Exchange markets, although some few markets are very busy. Marconis have attracted a noticeable degree of interest. Brazilian Tractions continue active and strong. New issues are not able to count now, as they were a month or two ago, upon certainty of success. In a couple of cases within the past fortnight, underwriters were left with 94 per cent. of their obligations: in two others, the public took 50 per cent. of the one and 15 per cent. of the other. This had a sobering effect upon promotions, and a lull in the rush of new-comers is welcomed by people who want to dispose of previously-subscribed scrip which they had stagged.

The rise in Marconi shares follows the argument of three weeks ago that, at anything under 20s., the price showed reasonable chance of responding to the quiet accumulation of shares that was then noticeable. The effect of this earlier buying made itself felt as the public began to come into the market, and the shares rose sharply to 22s. 6d. Concurrently, Canadian Marconis jumped nearly 1s. to 5s. 3d. The reason

for this mild enthusiasm is that already mentioned here, *viz.*, the hope of an early dividend declaration, and the confidence that, with personal differences no longer disturbing the internal policy of the company, the Marconi undertaking can develop the advantages that it unquestionably possesses. Marconi's, too, have obtained an important contract in competition with French and German firms, for wireless communication with Bulgaria.

Brazilian Tractions are up 6, at 160, a price which is about 60 points higher than that of a year ago. Sir Alexander Mackenzie, president of the company, stated in a newspaper interview that the board had not considered the question of capital reorganisation. He spoke very favourably of the position, financial and physical, of Brazil. The Stock Exchanges of London and Toronto continue to assume that a bonus of some kind will be forthcoming, either in the shape of a scheme for splitting the shares, or a "melon-cut" of assets. The market for this group is buoyant and excited, Brussels speculation supplementing the bullishness of other quarters. Brazilian Traction preferred are up to 135. Barcelona Tractions improved to 51.

Henleys gained half-a-crown on the news that the company had obtained a contract worth £300,000 from the Great Indian Peninsula Railway in connection with electrification of the main line. The announcement came the more pleasantly by reason of the disappointment recently caused by the Southern Railway's acceptance of a foreign firm's tender for machinery required on its system. Henley's now stand at 91s. 3d., at which the yield on the money is about 4¾ per cent. This is the same as Callenders afford at 68s. 9d. The Callender's Cable and Construction Company has declared 15 per cent. for the year, the same as before, and the profits of £356,000 are £13,000 less than those of the previous year that ended with December, 1925. In view of the coal strike and general upheaval, Callender's can be congratulated upon having come out of 1926 so well. The coal strike and severe competition are set down as the explanation of the Electric Construction Company's diminished profits shown in the report published the other day. For the year ended last March, the net profit came to £19,700, against £37,600 and £43,000 in the two preceding years, 1925 and 1924 respectively. The dividend, as recorded here last week, is 7½ per cent. against 10 per cent., and the price of the shares has eased off to 27s. 6d., at which the return on the money is 5½ per cent. General Electric 6½ per cent. preference strengthened to 24s. in the movement, now general, that is lifting all good preference shares on to a higher plane.

Yorkshire Electrics are better at 30s. The list of prices in the London group shows no change. Urban 4½ per cent. debenture is 6 points up at 92½. County of London Electric new debenture stands at 1¼ premium. The company's chairman and managing director, Sir Harry Renwick, K.B.E., received a baronetcy in last week's birthday honours, and, as recognition of a man who has done so much for the development of the electrical industry, the distinction will be deemed peculiarly fitting.

Resumption of vigorous buying of United River Plate Telephones resulted in a fresh gain of 7s. 6d., which took the price to 9¾. Orientals have rested after their jump last week. Automatic Telephones are better at 47s. 6d., and Internationals at 40s. Telephone Manufacturing at 6s. 9d. are unchanged.

Cable stocks keep very firm. Anglo-American deferred is ¼ higher. Eastern Telegraph ordinary is up a point. Globe preference gained ¼, but, on the other hand, Great Northern Telegraphs at 28½ are 15s. lower. International Telephone and Telegraph shares just gained ground at 146½.

British Electric Traction ordinary is 1 up at 149. Underground Electric Railways £1 shares have risen to within a shilling of their par value. The support for these shares serves to keep alive the expectation of early retirement of the company's 6 per cent. income bonds which, when carried out, should make a marked difference to the dividend prospects of the £1 shares. Other Home Railway stocks are still leaning to the lower side, and the rumbles of possible trouble amongst the miners is the latest addition to the market's handicaps. Metropolitan Consolidated has dipped to 60½, being now a point lower than Districts. That same apprehension of labour trouble has caused a slight decline to 52s. 6d. in Babcock and Wilcox, other shares in this division being similarly dull. Armstrongs remain at 3s. 6d.: there is talk of the likelihood that an American company may acquire the Newfoundland Power and Paper Company interests at present owned by Armstrongs, and which have hitherto proved more of a hindrance than a help to the company, whose annual meeting will be held on Thursday in this week.

Mexican Utilities have hardly varied, and the only movement in Argentines is a small advance in Anglo-Argentine Tramways 5 per cent. debenture stock. British Columbia issues are holding their ground, and the preferred retains its last week's gain of 2½ points. Amongst the lower-priced tramway descriptions, London & Suburban Traction ordinary nearly doubled in price, with a rise from ninepence to the present one-and-six. La Plata Trams keep at 4s. 9d. The rubber share market is dull and heavy; a decline in the price of the raw material caused surprise and mystification. Amongst new issues, Electric Finance preference rose from 3d. premium to 10½d. premium, and the debenture strengthened to 2 premium. Buenos Aires Lacroze debenture changes hands fairly frequently around 10s. premium.

Share List of Electrical Companies.

	Nom. £	Dividend. 1925.	Dividend. 1926.	Price June 7 1927.	Rise or fall.	Yield. p.c.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	14	14	56/9	—	4 18
Brompton Ordinary	1	10	8¾	25/-	—	5 12 0
Charing Cross Ordinary	1	15	8½	25/-	—	5 12 0
do. do. 4½ Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	8¾	25/-	—	5 12 0
City of London	1	15	10	18¾	—	5 1 10
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	30/6	—	5 5 0
County of London	1	15	7½	28/-	—	5 0 0
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Edmundson's Ordinary	1	7	8	26/9	—	5 19 8
do. 7% Pref.	1	6	7	23/6	—	5 19 2
Elec. Supply Corporation	1	10	10	32/-	—	6 5 0
Kensington Ordinary	1	15	8	25/-	—	5 12 0
Lancs. Light and Power	1	7½	7½	26/-	—	5 15 5
London Electric	1	10	8½	24/-	—	5 16 8
do. do. 6% Pref.	5	6	6	5⅝	—	5 6 8
Metropolitan	1	11	8	29/-	—	4 16 7
do. 4½% Pref.	1	4½	4½	17/-	—	5 2 16
Midland Counties	1	5½	6	22/6	—	5 6 8
Newcastle-on-Tyne Ordinary	1	7	5	23/-	—	4 6 11
do. 5% Pref.	1	5	5	17/6	—	5 14 3
do. 7% Pref.	1	7	7	24/6	+ 6d.	5 14 3
Notting Hill 6% Pref.	10	6	6	10	-	6 0 0
North Met. Elec. 6% Pref.	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	5	17½	8	35/6	—	5 9 10
South London	1	15	8½	25/-	—	5 12 0
South Metropolitan Pref.	1	7	7	1¼	—	6 3 0
Urban Ordinary	1	7	7	25/-	—	5 12 0
do. 6% Pref.	1	6	6	1⅛	—	5 13 0
Westminster Ordinary	1	15	8½	25/-	—	5 12 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	20/6	—	7 6 4
Yorkshire Elec.	1	8	8	30/-	+6d.	5 6 8
HOME RAILS.						
Central London Ord. Assented	Stock	4	4	71	—	5 12
Metropolitan	"	5	3	60½	—½	4 19 4
do. District	"	3½	3½	61½	—	5 13 10
Underground Electric	£1	Nil	1½	19/-	+6d.	1 11 5
do. do. Income	Bonds	6	6	103	—	* 17 8
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	Stock	6	6	101	—	5 19 0
do. Def.	"	1½	1½	24½	+⅛	6 2 5
Automatic Telephone	1	3	10	47/6	+1/8	4 3 6
Chili Telephone	5	5	6	7⅞	—	3 17 5
Eastern Extension	10	10	10	18¾	—	*5 6 8
Eastern Tel. Ord.	Stock	10	10	182½	+1	*5 9 7
Globe Tel. and T. Ord.	10	10	10	18¾	—	*5 6 0
do. do. Pref.	10	6	6	11⅛	+⅛	5 8 1
Great Northern Tel.	10	20	20	28½	—¾	7 0 4
Indo-European	25	8½	10	46½	—	*5 7 6
Marconi	1	Nil	Nil	1⅛	+1/16	... ...
Marconi-Marine	1	7½	8¾	27/-	—	6 9 8
Oriental Telephone Ord.	1	12	12	56/3	—	*4 5 3
United R. Plate Tel.	5	8	8	9¾	+⅛	*4 2 1
Western Telegraph	10	10	10	17¾	—	*5 12 8
HOME AND FOREIGN TRAMS, &c.						
Anglo-Arg. Trams First Pref.	5	5½	5½	8¼	—	7 17 2
do. do. 2nd Pref.	5	6	6	8½	—	8 2 8
do. do. 5% Deb.	Stock	5	5	71½xd	+1	7 0 0
British Electric Traction Ord.	"	8	—	149	+1	5 7 5
do. do. 6% Pref.	"	6	6	120½	—	6 12 10
Brazil Traction	100	5	6	160	+6	3 15 0
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	89½	—	5 11 9
do. do. Preferred		6¾	6¾	121	—	5 8 4
do. do. Deferred	"	8	—	158	—	*5 1 3
do. do. Deb.	"	4½	4½	80½	—	5 5 7
London & Sub. Trac. 5% Pref.	1	Nil	Nil	7/9	—	Nil
London United Tram. Deb.	Stock	4	4	52½	—	7 12 5
Mexico Trams, 5% Bonds	—	5	5	81½	—	6 2 8
Mexican Light Common	100	Nil	Nil	44	—	Nil
do. Pref.	100	Nil	Nil	110½	—	Nil
do. 1st Bonds	—	5	5	74½	—	6 14 3
Yorkshire (West Riding)	1	8	—	8/9	—	... ...
MANUFACTURING COMPANIES.						
Babcock & Wilcox	1	12	12	52/6	—1/16	4 19 1
British Aluminium Ord.	1	12½	10	43/-	—	4 13 0
British Elec. Transformer Pref.	1	Nil	7	18/3	—	7 13 6
British Insulated Ord.	1	15	15	67/6	—	4 8 11
Brush Ord.	1	10	10	26/3	—	7 12 4
Callenders	1	15	15	3 7/16	-	4 7 3
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	13/6	—	... ...
Edison-Swan	4/-	10	10	10/	—	4 0 0
do. 5% Deb.	Stock	5	5	85	—	5 17 8
Electric Construction	1	10	7½	27/6	- 1/6	5 9 1
Enfield Cable Pref.	1	7½	7½	25/6	—	5 17 8
English Electric	1	Nil	Nil	10/-	—	... ...
do. do. Pref.	1	8	—	13/6	—	... ...
Gen. Elec. Pref.	1	6½	6½	24/-	+6d.	5 8 4
do. Ord.	1	7½	—	30/6	—	4 18 4
Henley	1	20	—	91/3	+¼	4 7 9
do. 4½% Pref.	5	4½	4½	4½	—	5 0 0
India-Rubber	1	5	5	1¼	—	*4 9 0
Johnson & Phillips	1	17½	12½	2½	—	5 0 0
Met.-Vickers Ord.	1	8	8	27/6	—	5 11 4
do. Pref.	2	8	8	2¾	—	6 14 9
Siemens Ord.	1	7½	7½	27/6	—	5 9 1
Telegraph Construction	12	10	10	23½	—	*4 4 2

* Dividends paid free of Income Tax.

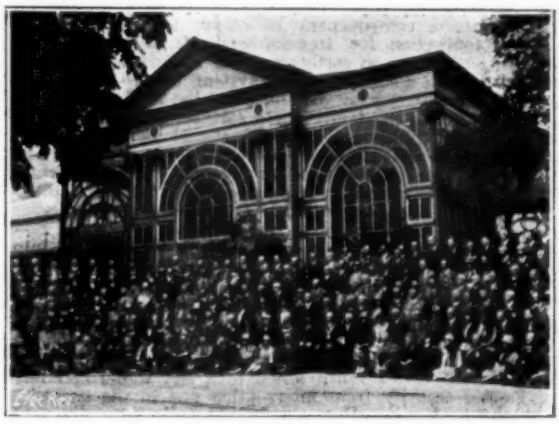
The Incorporated Municipal Electrical Association.—III.

Annual Convention at Buxton.

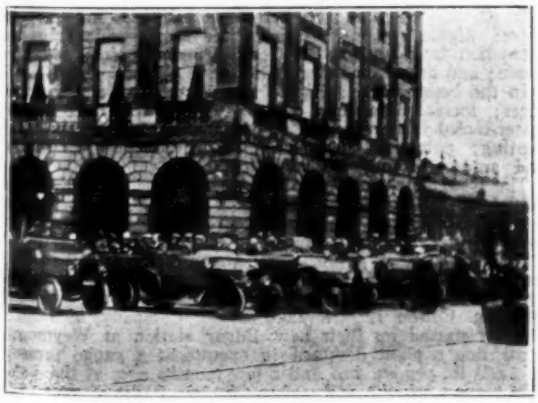
ON Wednesday, June 1st, Mr. T. Roles read extracts from his long paper on "Recent Developments in Power Plant Design," of which an abstract follows, and an excellent discussion took place. The author passed in review the chief developments of recent years in every stage from the coal pile to the condenser, giving special attention to the economies that may be obtained from the use of higher steam pressures and temperatures, together with the difficulties met with in their adoption and the methods of coping with them. He showed that a net increase of efficiency of 13.8 per cent. might be expected as the result of raising the steam pressure from 200 to 1,500 lb. per sq. in., corresponding to a saving of 0.17 lb. of coal (11,000 B.th.u. per lb.) per kilowatt-hour generated. He pointed out, however, that the additional cost of the high-pressure plant could not be stated in general terms, as such plant was not yet available in the market; the better the load factor, the higher the steam pressure that could be economically employed. Particulars were given of the plant designed to work at 1,100 lb. per sq. in. which Mr. Roles is installing at Bradford, and many details in connection with feed-heating by partially expanded steam, reheated steam, boiler furnaces, air pre-heaters, pulverised fuel, and automatic boiler control were dealt with in the paper.

In the afternoon most of the members drove to the Derwent Valley waterworks, in charabancs and in their own cars, by routes through picturesque and interesting scenery; the weather left something to be desired, the sky being overcast and the air misty, but the trip was very enjoyable. For the evening there was no special programme, the time being spent very happily in dancing and conversation; the organising ability of Mr. Hewlett, the manager of the Palace Hotel, in this connection was very much appreciated.

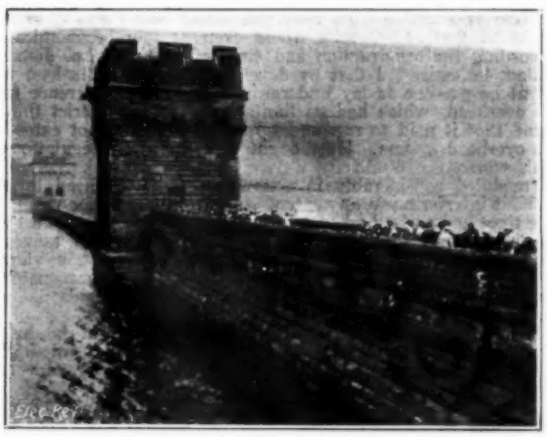
Members of the I.M.E.A. assembling at the Opera House, Buxton.



Posing for the official photograph in the Pavilion Gardens.



Mobilising for a visit to the Waterworks.



The I.M.E.A. at the Derwent Valley Waterworks.

At the annual business meeting, which was held in private, Mr. Frederick W. Purse, M.I.E.E., chief engineer and manager of the electricity department of the County Borough of West Ham, was elected president for the ensuing year; and Mr. A. Nichols Moore, borough electrical and tramways manager, Newport, Mon., was elected vice-president.

Distribution over an Extensive Area.

Discussion on Mr. Wm. C. Bexon's Paper.

Mr. J. W. BURR, M.I.E.E., Swansea, in opening the discussion, said that economy in all transmission lines was dependent upon the voltage adopted, the object being to erect a line at the least possible capital cost, and with the lowest annual loss of energy. He did not think that for very long transmission lines the 1,000-V per mile rule would apply. Unfortunately, in transmitting energy over large areas it was almost impossible to have overhead construction throughout the whole distance, and hence underground cables often had to be used. Troubles were undoubtedly being experienced in the use of cables working at 33,000 volts and above. The frequent and sometimes lengthy interruptions which took place in the supply, due to cable failures, not only involved the users and manufacturers in financial loss, but had also delayed the electrical development of certain areas for years. The faults might be due to the method of construction, or they might be due to resonance in the line, or to a combination of the two. It must be borne in mind that on all large transmission systems both induction and synchronous machines were running in parallel and the conditions might at times be favourable to resonance, which need not be produced with the fundamental, but with higher harmonics with which the fundamental waves were frequently accompanied. It might, of course, be that the supply authorities were asking for trouble by offering a reduction in the price of electricity supplied at a high power factor, particularly if a bonus were allowed for leading wattless components. In voicing his preference for the star connection for transformers, Mr. Burr said that should a fault occur to earth on a star-connected line it was possible, as with a delta-connected system, to give a supply in the case of emergency by disconnecting the earth connection and running with the faulty phase earthed. He thought the phase on which the fault occurred should be permanently earthed until the fault was removed. He agreed with the author that the continuity of supply was an all-important factor, but how was this to be obtained? With regard to the suggestion that in a transmission system a duplicate feeder on the same transmission poles was the most economical proposition, he asked whether the author took the six lines into each consumer's premises, what arrangements he had for isolating a faulty line, and how he repaired a fault without shutting down the line. Mr. Burr said his own view was that whenever possible a ring main with directional relay protection was the best proposition. While the ring main with the protective apparatus would cost more than a single six-wire line, it would serve a much larger area and would certainly give greater security from interruption due to the necessity for overhaul. Unless collieries and large works generally were assured that continuity of supply could be reasonably relied upon no large electrical developments would take place in the future, however low the cost of the energy might be. The electrical development of many areas had been set back for years through the repeated interruptions in the supply. In giving small supplies to farmers near a transmission line, he suggested that the most economical proposition was to give the supply to a small company consisting of farmers and others interested, and let them distribute it themselves. A single supply to a farm from a 33,000-V line was not likely to be a paying proposition. He held the view that, generally speaking, a feeder pressure of 6,600 volts was better than 3,300 V, or it might be that 11,000 volts would even be more economical. Regarding the construction and costs of overhead l.p. distribution, he suggested that by developing the domestic load it might be possible to lay underground mains in preference to the overhead, which had its limitations. In his district they found that it paid to run underground mains and not extend the overhead system. He thought that the many regulations with which the electricity authorities had to comply might be modified considerably in connection with overhead lines without interfering to any extent with the safety of the public. The time had arrived when a bold policy should be adopted by all undertakings in regard to the liberal spending of money on distribution and transmission systems, both with a view to assuring continuity of supply and allowing for all reasonable development in both the industrial and domestic loads likely to take place in the near future.

Mr. W. A. TURNBULL, M.I.E.E., Aylesbury, said he had adopted 11,000 V in his undertaking for overhead transmission. He was experimenting with a new kind of pole at Wendover, and so far with success.

Captain J. M. DONALDSON, M.C., M.I.E.E, chief engineer of the North Metropolitan Electric Power Supply Co., said he was particularly interested in overhead lines because he had just put up 100 miles of them. He suggested that the Ministry of Transport should issue a small document explaining various points with regard to overhead lines; also that a form of consent should be prepared by the Ministry which would free supply undertakings from heavy legal charges.

Mr. T. HALL, Burton-on-Trent, said he had had a tremendous number of insulators broken. In one meadow there were over 27 of them smashed by colliery boys in one day. He had changed the colour from white to brown, but still the nuisance went on.

Mr. R. BORLASE MATTHEWS M.I.E.E., East Grinstead, congratulated Mr. Bexon upon the initiative and enterprise he had shown in his undertaking. Mr. Bexon had over 73 farm consumers, the largest number in any one area. Two years ago there were only 200 farmers using electricity in this country, but to-day there were 700, and the number was rapidly increasing. In the rest of the world there were about a million farmers using electricity to-day. He had had the advantage of talking to farmers as a farmer, and every one he had spoken to was satisfied that electricity was far cheaper than other forms of power. Mr. Matthews suggested that in all the rural distribution areas they should have power demonstrations of all the appliances that could be reasonably used by farmers. He considered that there was a tendency to supply farmers with electricity too cheaply.

Mr. BEXON, in reply, said he had tried white, brown, green, and glass insulators and an unbreakable insulator, but the last named would not stand up to the high pressure and he had to substitute porcelain. One week-end he had over 72 insulators broken. The Scotch farmer was beginning to take electricity for power and lighting. One paid him over £39 for power last year and another for lighting paid him over £44. The farmer had not realised that electricity would enable him to do work in one day that it would take three months to do under the old conditions.

Mr. R. B. MITCHELL, M.I.E.E., Glasgow, proposed a vote of thanks to Mr. Bexon, and said he admired his courage and enterprise in developing his areas. He had no overhead transmission lines in his own area, but the paper came at a very opportune time, when so much attention was being paid to the question of supplying areas that were not purely industrial.

Mr. BEXON briefly replied.

Recent Developments in Power Plant Design.

Their Effects on the Economy of Generation.

By THOMAS ROLES,
City Electrical Engineer, Bradford. (*Abstract.*)

HAVING been invited to prepare a paper on the above subject, the author assumes that the reason underlying his selection for the task is that certain extensions which are now being made to the plant in the Bradford Corporation's Valley Road power station have aroused interest, as it has been decided to install plant designed to work at a higher steam pressure and temperature than any other plant previously put down in this country. Also last year the author had the opportunity of visiting a number of the largest and most efficient steam-operated generating stations in the United States, but he has had little or no actual working experience with much of the power-station equipment which will be commented upon.

The Valley Road power station as at present equipped is operating under steam conditions of 200 lb. pressure per sq. in., with a total steam temperature averaging about 630 deg. F. It is also working under what is generally regarded as a disadvantage, in that the circulating water for the condensers is cooled by means of towers. Under these conditions the thermal efficiency of the station for the year ended March 31st, 1927, based on units generated, was 16.68 per cent., the British thermal units per unit generated being 20,450, and the station load factor 29.5 per cent.

In connection with modern generating stations, the chief developments during recent years have been as follows:—

In the turbine room: Higher steam pressures and temperatures; higher rotational speeds for large turbines; steam extraction from turbines for feed-heating purposes; re-heated steam; and improvements in the design of condensers.

In the boiler house: Higher steam pressures and temperatures; increased capacity of boiler units; re-heater boilers. water-cooled furnace walls; air pre-heaters; regenerative feed heating; pulverised fuel firing; improved types of stokers; and automatic combustion control.

The Newcastle-upon-Tyne Electric Supply Co., Ltd., on the advice of Messrs. Merz & McLellan, some ten years ago decided to adopt a working pressure of 475 lb. per sq. in. in connection with a station to be erected by them at North Tees, near Middlesbrough, which was put into service in 1920. In the United States of America and on the Continent, however, stations are being operated at higher pressures. In 1925 the Edison Electric Illuminating Company, of Boston, U.S.A., started up their new Edgar station at Weymouth, containing a plant designed to operate at a gauge pressure of 1,200 lb. per sq. in., and a few months ago, at the Lakeside station of the Milwaukee Electric Railway and Light Company, a plant of more than double the capacity of that at Boston was put into operation at a working pressure of 1,400 lb. per sq. in. There are also in the United States several stations designed to operate at pressures of from 550 to 650 lb. per sq. in., the total plant capacity for working at these pressures in that country, either running or projected, being close on one million kilowatts.

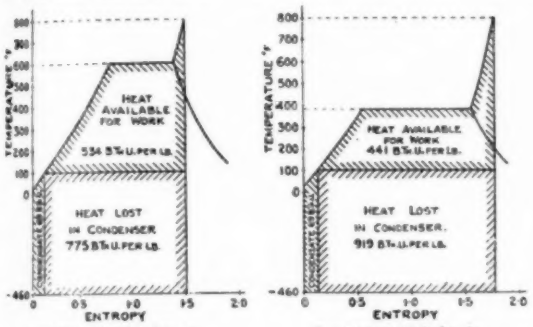
Although American engineers have gone well ahead in respect of the utilisation of higher steam pressures, they have not for the most part adopted higher total steam temperatures than are employed in this country. Generally speaking, the steam temperatures in use in their modern stations are from 700 to 750 deg. F., and in very few instances has a temperature as high as the latter figure been adopted.

With regard to Continental practice, the outstanding example of high steam pressure is the Langerbrugge station of the Centrales Electriques des Flandres, near Ghent, where since 1925 plant has been in operation at a working pressure of 800 lb. per sq. in. gauge and a total steam temperature of 840 deg. F., this being, so far as the author is aware, the highest steam temperature at which any power-station plant in the world is normally operated.

From what has been seen and learned in the course of his investigations, the author has come to the conclusion that the practical difficulties incidental to the working of extra-high-pressure steam plant are by no means insurmountable or likely to prevent the extended use of such pressures.

The English Electric Co., Ltd., in connection with the Benson plant at Rugby, made experiments with steam at a pressure of about 3,200 lb. per sq. in., which is known as the critical pressure, when the densities of water and steam are equal and the water passes into steam without ebullition. Very useful data have been obtained, but not published.

In considering the economy which theoretically may result from the use of higher steam pressures, a reference to the temperature entropy diagrams, fig. 1, will be useful. These



A.—Steam 1,500 lb./sq. in. Vac. 28 in. Hg.

B.—Steam 200 lb./sq. in. Vac. 28 in. Hg.

Fig. 1.—Heat Distribution per lb. of Steam.

diagrams have been prepared from figures obtained from "The Enlarged Callendar Steam Tables," and are based on steam at a temperature of 800 deg. F. and on a vacuum of 28 in. The hatched area in fig. 1A represents the total heat in one pound of steam at a pressure of 1,500 lb. per sq. in. absolute, *viz.*, 1,378 B.th.u. The area similarly treated in fig. 1B represents the total heat in one pound of steam at a pressure of 200 lb. abs., *viz.*, 1,429 B.th.u. The upper portions of the hatched areas in these diagrams represent the heat available for work, which at 1,500 lb. per sq. in. is 534 B.th.u., or 1.2 times the heat available at 200 lb. per sq. in., which is 441 B.th.u. The rectangular figures forming the lower portions of the hatched areas represent the heat rejected to the condenser, which is 775 B.th.u. at 1,500 lb. pressure and 919 B.th.u. at 200 lb. pressure, or 15.7 per cent. less in the case of the higher pressure. The diagrams therefore indicate that at the higher pressure the total heat in one pound of steam is 3.57 per cent. less than at the lower pressure, but, on the other hand, the heat available for work is 21 per cent.

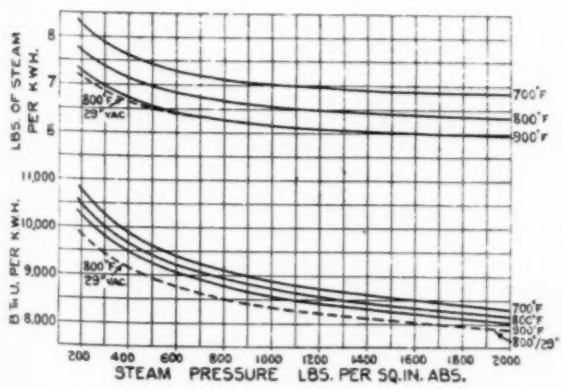


Fig. 2.—Consumption Variations with Steam Pressure.

greater, or, putting the matter in another way, it can be said that in the utilisation of a B.th.u. of heat in steam at a pressure of 1,500 lb. per sq. in., 26 per cent. more work is done than in the utilisation of a B.th.u. in steam at 200 lb.

The full-line curves in fig. 2 show the theoretical steam and heat consumption per kWh at various initial steam pressures between 200 and 2,000 lb. per sq. in. abs. when working with a vacuum of 28 in. and temperatures of 700, 800, and 900 deg. F. The curves given in dotted lines show such consumptions at the various pressures when the steam temperature is 800 deg. F. and the vacuum 29 in. The curves clearly indicate the increases in efficiency which may be obtained as the steam pressure and temperature are raised. From the curves in fig. 2 those in fig. 3 have been produced, illustrating the percentage rate of decrease in heat consumption with steam at various pressures of from 200 lb. to 1,600 lb. per sq. in. abs., superheated to a total temperature of 800 deg. F.

The operating efficiencies likely to be obtained in connection with various portions of extra-high-pressure steam plant may be compared with the efficiencies of lower-pressure plant.

Dealing first with prime movers, it is impossible to convert all the heat available in the steam into useful work at the turbine coupling, as losses take place in all turbines between the stop valves and exhaust branches, as well as in the bearings and by radiation. The best efficiency at the turbine coupling known to the author as having been actually obtained under such conditions is about 81 per cent.

It is not at present possible in a turbine built for a high pressure to abstract work from the expansion of the steam so efficiently as can be done in a turbine constructed for a lower initial steam pressure, and it is doubtful whether it ever will be possible to produce a high-pressure turbine as efficient as one built for pressures of, say, from 180 to 300 lb. per sq. in.

High-pressure turbines have to deal with steam of much greater density than normal-pressure machines, consequently the blade windage and disk friction must be greater. The steam guide passages and blade heights must be smaller and the clearance spaces of greater relative proportion, with consequent increased leakage loss. It would appear that in all probability high-pressure turbines will prove from 5 per cent. to 10 per cent. less efficient than normal-pressure turbines of the same capacity operating under other similar conditions.

With boilers working at high steam pressures the temperature of the flue gases leaving the steam-generating surfaces must of necessity be higher than with normal-pressure plant. This disadvantage, however, can be largely obviated by the use of larger economisers or air pre-heaters, or by a combination of both. Boiler-plant efficiencies under any conditions of pressure cannot be expected to exceed 90 per cent., as this figure closely approaches the physical limit. With high-steam-pressure plants the feed pumps require considerably greater power for their operation than pumps used for dealing with equal quantities of water in connection with normal-pressure boilers. It is not, however, possible at present to

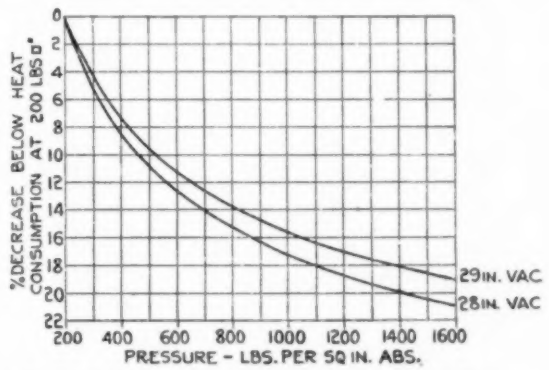


Fig. 3.—Relation between Heat Consumption and Steam Pressure.

obtain pumps for high-pressure working equal in efficiency to those suitable for operating at normal pressures. On the whole, it may be said that the efficiency of a high-pressure boiler should be little below that of a normal-pressure one.

After making the necessary allowance for the difference in efficiency between high- and normal-pressure turbo-generators, it may be taken that the original figure of 26 per cent. will be reduced to 16.41 per cent. if the following turbine and generator efficiencies are assumed:—Efficiency of high-pressure turbine, 74 per cent.; efficiency of normal-pressure turbine, 80 per cent.; and efficiency of electrical generator, in each case 95 per cent. The figure 16.41 per cent. is, however, only a measure of the increase in efficiency which may be realised by the utilisation of steam at higher pressure. The ultimate economy must be shown in terms of coal consumed.

If it be assumed that the efficiency of a boiler plant for normal pressure is 90 per cent., a figure of 88 per cent. may be taken as the efficiency of a high-pressure plant, both figures being based on the net calorific value of the fuel. On this assumption the figure of 16.41 per cent. is reduced to 13.8, and it may therefore be said that one may reasonably expect to obtain from the utilisation of a B.th.u. in a plant constructed to work at 1,500 lb. per sq. in. at least 13.8 per cent. more work than from the utilisation of a B.th.u. in a plant constructed for working at a pressure of 200 lb. This corresponds to a reduction in overall heat consumption of 1,870 B.th.u. per kWh, and assuming that the boiler is fired with coal having a calorific value of 11,000 B.th.u. per lb. net, the saving in coal per kWh generated would be 0.17 lb.

With regard to capital charges, the price paid for the plant determines the amount of the annual interest payments to be made on the capital expenditure, while the probable life of the plant fixes the sum to be set aside for depreciation.

The author considers that the additional cost per kW will increase in greater proportion the higher the pressure and the temperature adopted. From this it follows that in giving

consideration to the installation of high-pressure plant the question of the load factor at which the plant is to be run must receive careful thought. The load factor will determine the extent to which it is economical to adopt high-pressure plant in connection with any particular undertaking.

This fact has resulted in two different methods being adopted in which high-pressure steam is utilised in connection with large power plants. Under the first method the whole of the plant is laid out for high-pressure working, and under the second method high-pressure plant (used in connection with an appropriate proportion of normal-pressure plant) is installed of only sufficient capacity to deal with the base load of the station, the remaining load of poor load factor being dealt with by normal-pressure and, therefore, cheaper plant. In the first case each turbine—usually a multi-cylinder machine—receives steam direct from high-pressure boilers. In the second case only one or two turbines of comparatively small size are operated at high pressure, and the steam is exhausted from them into the normal-pressure steam range and utilised in any of the normal-pressure turbines coupled to that range.

Fig. 4 represents diagrammatically the second method, which the author has adopted in connection with extensions which are now taking place at the Valley Road station.

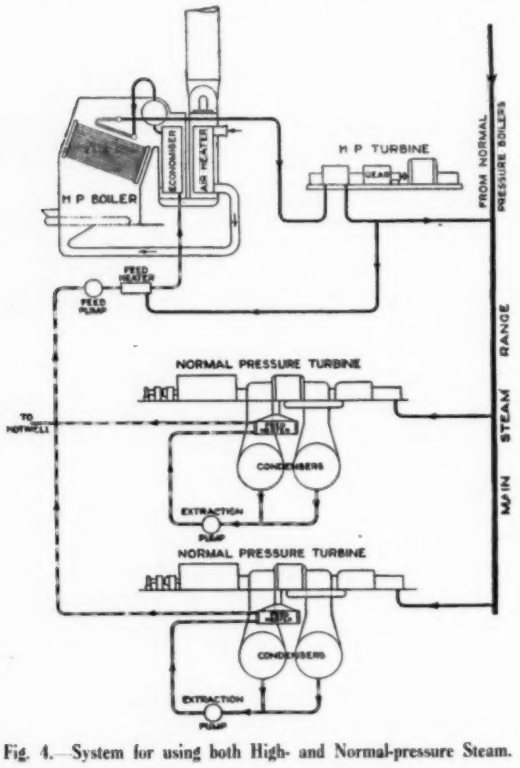


Fig. 4.—System for using both High- and Normal-pressure Steam.

It would appear that capital charges and the cost of repairs and maintenance will be somewhat higher in the case of h.p. plant than in that of normal-pressure equipment, and that the higher the price of fuel the greater are the monetary savings which can be effected. Assuming each type of plant to be run under equal conditions as regards vacuum, the lower the vacuum the greater is the saving attendant upon the use of h.p. plant.

Among the advantages gained by the use of machines having a speed of 3,000 r.p.m. over machines of similar capacities designed for lower rotational speeds are the following:—Lower initial cost; lower steam consumption; greater reliability; and greater ease of overhaul owing to weight of moving parts being less.

It is a fortunate fact that the tendency to increase the rotational speed of turbines harmonises with the movement in the direction of an increase in steam pressures, as in high-speed machines disks of smaller diameters can be employed and almost complete circumferential admission can be adopted, which, amongst other factors, and in view of the density of steam increasing with its pressure, make for greater efficiency in the utilisation of high-pressure steam.

The extent to which regenerative feed heating can be used depends, among other factors, upon the method adopted for firing the boilers. It is impossible to design a station to work at the highest efficiency unless the functions of the turbines and auxiliaries are properly correlated to those of the boilers and auxiliaries. With the introduction of regenerative feed heating the relationship between the turbine and boiler rooms becomes far more intimate and still closer if re-heating of the steam is carried out. This fact will in future cause responsible engineers considerable difficulty when dealing with contracts for the installation of new plant; in the event of failure to obtain a certain anticipated overall efficiency from the coal bunker to the switchboard it will be difficult to attach responsibility to any particular contractor when different portions of the plant have been installed under separate contracts.

It is now generally the practice in modern power stations to increase the temperature of the steam, at whatever pressure it is generated, from saturation temperature to from 550 to 700 deg. F. To attain the best results with regard to efficiency and to prolong the life of the blading, it is desirable that some degree of superheat should be retained in the steam up to the last expansion, and that the steam should enter the condenser in a dry saturated condition. Unfortunately it is impossible to obtain this desideratum even when steam utilised at as low a pressure as 200 lb. per sq. in. is superheated to a total temperature of 800 deg. F.

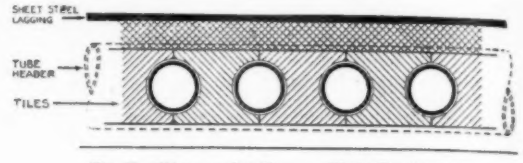


Fig. 5.—Water-cooled Furnace Wall (Bradford).

The question of re-heating or otherwise can only be settled after carefully considering whether the expenditure of the additional capital involved in the provision of such plant will be justified, having regard to the saving in coal which may be effected by increased thermo-dynamic efficiency and by a reduction in the cost of turbine maintenance consequent upon the greater life of the blading in the low-pressure stages of the turbine. In the opinion of the author such justification will not be found except in the case of certain h.p. plants.

Generally speaking, it may be said that the justification for the use of boilers of large capacity is found in the reduction in capital expenditure for a given output, and in the greater ease of operation, rather than in any increase in thermal efficiency. It is the author's opinion that with a boiler having an evaporative capacity of about 60,000 lb. per hour, one can obtain a thermal efficiency as high as is practically and economically possible.

The introduction of pulverised-fuel firing has greatly assisted in the construction of boilers having large outputs, but comparatively small heating surfaces. It is doubtful whether it would have been possible to build boilers of such huge capacity as those which are in use in America and to operate them efficiently if any other method of coal firing had been adopted.

As a consequence of the greater efficiency attained in connection with boiler plant and of higher rates of combustion in boiler furnaces, the cost of maintaining the brickwork used in combustion chambers designed on lines which proved fairly satisfactory for less efficient boilers and lower rates of combustion has considerably increased. As the combustion chamber of a modern boiler is usually of far greater capacity in proportion to the heating surface than was the case some years ago, the amount of refractory material is necessarily also very much greater, and the cost of maintaining it is correspondingly higher. In order to keep the cost of furnace repairs down to a reasonable figure and to enable boilers to be continuously operated over long periods without the necessity of furnace repairs, furnaces have recently been designed to maintain the walls at a sufficiently low temperature to prevent rapid deterioration of such materials. The methods most usually adopted are:—the provision of ducts in the brickwork of the walls, through which cold air is passed; walls constructed partly of refractory material and partly of steel tubes; and walls made up entirely of steel tubes of special design unprotected by refractory material.

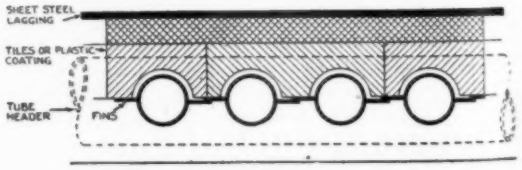


Fig. 6.—Murray Fin-tube Furnace Wall.

The h.p. boiler which is to be installed at Bradford is being fitted with water-cooled furnace walls of the refractory-material and steel-tube type, fig. 5. The desirability of utilising air pre-heaters has arisen largely as a result of the adoption of regenerative feed-water heating, and, as this method is being increasingly employed, air pre-heaters would appear likely to be much more commonly used in the future than they have been hitherto. Fig. 6 shows a section of a wall of a Murray Fin-tube furnace.

It would appear that where air pre-heaters are employed in connection with stoker-fired boilers, the grate area could be somewhat reduced, and in connection with pulverised-fuel-fired boilers the combustion chamber might be of somewhat smaller capacity, thus in each case reducing the capital cost.

It will probably be agreed that the greatest innovation in recent years in connection with boiler houses of power stations has been the introduction of pulverised-fuel firing. The following appear to be the principal claims made in favour of the use of pulverised-fuel plant:—Extreme cleanliness of

operation; ease of control; ability quickly to follow highly fluctuating loads; fuels of variable qualities mixed together in the same bunker can be better dealt with; low-grade fuels can be burned more satisfactorily and utilised more efficiently; a high sulphur content or a high ash content of the coal does not affect combustion to the extent it does with stoker firing; banking losses are considerably reduced; moving parts and mechanism are eliminated from the furnaces; furnace refractories last longer, owing to the fact that the highest temperature is in the centre of the furnace away from the walls; higher outputs per square foot of heating surface can be obtained from the boilers; and a higher average boiler efficiency can be maintained than that maintained by the use of stokers which under test conditions would give equally good results as regards efficiency.

In deciding whether or not to adopt pulverised-fuel firing the chief matters for consideration are the capital cost and the costs of operating and maintaining the plant, as compared with similar costs in respect of stoker plant.

The author reluctantly came to the conclusion that at Bradford the generation of electricity could be effected more cheaply in the immediate future by the adoption of stoker firing than by the installation of pulverised-fuel plant. He, however, realises that the present conditions may not be permanent, and, therefore, has arranged for the boiler furnace to be so

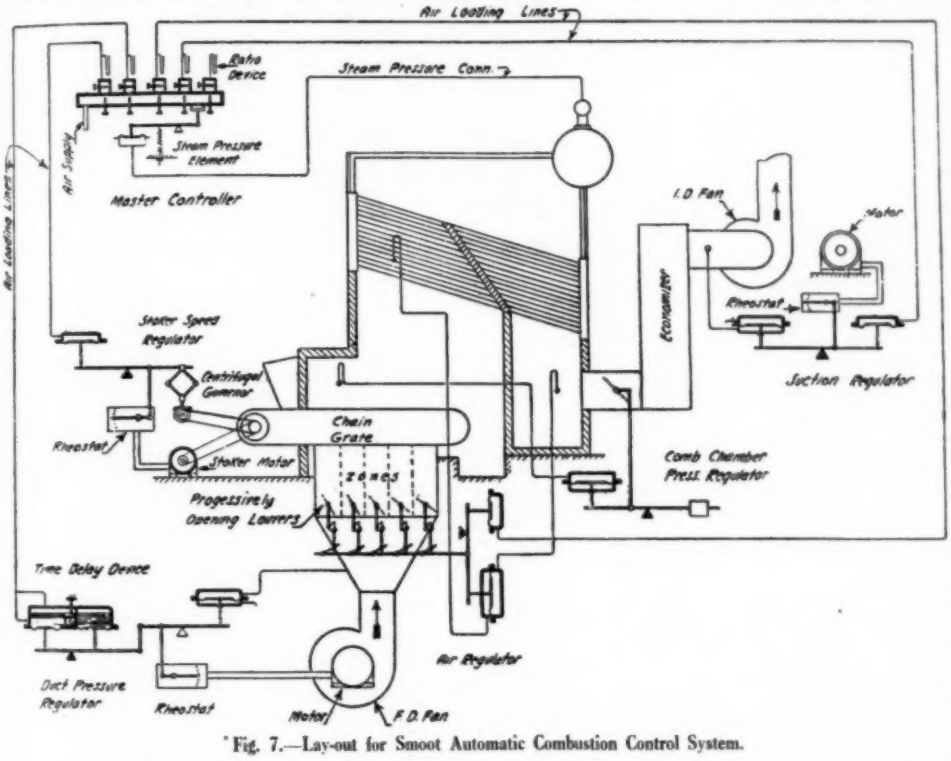


Fig. 7.—Lay-out for Smoot Automatic Combustion Control System.

constructed that pulverised-fuel firing can be adopted at a later date if then found desirable.

The type of stoker which the general consensus of opinion in this country deems most suitable for the burning of British coals under water-tube boilers is that known as the chain or travelling grate. During recent years methods have been devised of enclosing the grates, which have also allowed of their use with air pre-heated to a temperature of about 250 deg. F.

So far as the author is aware, no system of automatic boiler control has yet been installed in Great Britain. Such installations to a large number, however, have been put into use in America, with, it is claimed, a marked gain in efficiency. The principle on which these automatic installations work is the maintenance of a constant steam pressure at all loads. Any variation in the steam pressure is transmitted to a number of regulators, whose combined function is to bring the pressure back to normal.

The two systems of automatic combustion control which appeared to the author to be most generally employed in the United States were those made by the Smoot Engineering Corporation, of New York, and the Bailey Meter Company, of Cleveland. In the Smoot system the variations in pressure are transmitted from the master controller to the regulators by air-pressure impulses. The regulators consist primarily of a diaphragm, one side of which is under air pressure transmitted from the master controller and is balanced by some force which bears a direct relation to the load on the boilers for the function which that individual regulator has to perform. The movement of the diaphragm is transmitted by levers actuated by an oil relay to the various rheostats, dampers, and other devices. Fig. 7 shows in diagrammatic form a lay-out of the Smoot automatic combustion control, as arranged for a stoker-fired boiler.

Discussion on Mr. Roles's Paper.

Mr. I. V. ROBINSON, of the B.E.A.M.A., said there was no doubt that high-pressure plant would cost more than plant of normal pressure. Both the Bradford Corporation and the manufacturers who were installing the h.p. equipment there were to be commended for their enterprise. Not until things had settled down should we be able to get with any degree of accuracy the difference in the costs of normal- and high-pressure plant. He suggested that it would be an advantage to the industry if a single-cylinder machine were used for outputs very much in excess of anything that had been attempted in this country, with an efficiency of 80 and not 83 per cent. A single-cylinder machine could be used for up to 50,000 kW with a normal-pressure plant. Undue emphasis was being put on thermal efficiency, which had been forced upon the engineers by the publication of tables by the Electricity Commissioners, and this, he thought, was not in the best interests of the industry. If thermal efficiency were the only thing we were working for, then there was no doubt which stations would win—those with internal-combustion engines. But thermal efficiency was not the goal we were striving for. He suggested that it might be possible to grade stations on the average price per unit, but it would be unfair to compare the average prices of purely residential districts with areas that were solely industrial. Would it not be possible to grade and classify the stations according to the percentage sold for lighting purposes? That would not only take into consideration thermal efficiency, but also initial costs. Referring to the re-heating of steam, he said there seemed much still to be done before re-heating was a success. The question of steam being re-heated by superheated steam was a matter that was worthy of consideration. He doubted the suggestion that the efficiency of the condenser had reached its maximum, in view of the improvements that were being made.

Mr. R. A. CHATTOCK, M.I.E.E., said that for the past 18 months he had been engaged on the design of a new power station at Birmingham, and he found that he had been following to a very great extent along the lines given in the paper. When he was at the Valley Road station they had a thermal efficiency of 10 per cent.; now Mr. Roles had got it up to 16.68 per cent. The new Birmingham station was designed for a thermal efficiency of 23 per cent., which would be obtained quite easily, even with the use of cooling towers. The high efficiency would be obtained largely by the bleeding of the turbines and heating the feed water in that way. He did not think that the method of re-heating steam was likely to be generally adopted. The idea of placing the contracts for the whole of the plant with one main contractor had been adopted at Birmingham.

Mr. CHITTENDEN, of the English Electric Co., pointed out that at Rugby they were generating steam at 3,200 lb. per sq. in. and using it at 1,500 lb., and they got an efficiency of over 80 per cent. without using a re-heater or other things. He had seen tests recently on a high-pressure boiler on which 88 per cent. efficiency was reached. There were a number of stations in this country which could not put on feed heating, because the turbines were not designed for it, nor could they alter the vacuum; but they could add a small percentage of high-pressure plant.

Mr. J. H. BOWDEN, M.I.E.E., Poplar, gave some details of a boiler he had seen in Berlin. It was designed to work at 3,250 lb. pressure and the firm expected to get an increase over and above the existing plant in thermal efficiency of 14 or 15 per cent. The quantity of water in the boiler was only 80 gallons, and it was fired by pulverised coal.

Mr. W. BAYLISS, of Messrs. Babcock & Wilcox, Ltd., said the pressure that had been adopted at Bradford was not the highest that had been used commercially in connection with power generation. The contractors were out to help the electrical engineers of this country in any developments they desired to make. Probably at the present time there was a limited number of cases where conditions justified the disfavour which was accorded to h.p. delevelopment, and where

capital costs were a serious factor. Twenty-five years ago the maximum steam pressure was in the neighbourhood of 225 lb. per sq. in., but to-day plant was operating at 1,200 lb. He said we must go on in this country, we had to lead the world. There were engineers to-day willing to go beyond the pressures and temperatures mentioned in the paper. Mr. Bayliss asserted that although everyday improvements were being made in the detailed plants associated with pulverised fuel, it was a fact that at the present time there was no pulverised-fuel plant in this country that could show as high an efficiency as had been obtained from stoker-firing plant.

Mr. A. Q. CARNEGIE, of Messrs. C. A. Parsons & Co., said that re-heating had been tried in this country, but up to the present not wholeheartedly. A re-heating plant had been put up at North Tees, the steam temperature being raised 150 deg. F. The recently completed contract for Chicago aimed at 750 deg. F. for the re-heat. He could not see any advantage in re-heating by live steam. If it were possible to raise the temperature of the re-heated steam to 1,000 deg. F., it was also possible to take that steam into the turbine direct, which would have the same effect as taking the steam out of the turbine later and re-heating it. Most of the first-class engineering firms were always anxious with the pioneer in any new development to bear a fair share of the cost. He hoped that when Mr. Roles had got his h.p. system working he would give a paper on its results.

Mr. D. WILSON, of International Combustion, Ltd., said he was still prepared to defend the mechanical stoker in its useful sphere of influence, but he had no hesitation in following the predictions the author had given. The whole question was one of capital costs, which were rapidly tumbling down.

Dr. S. Z. DE FERRANTI reminded the members that an engineer named Perkins once ran a boiler and engine in this country on 1,000 lb. steam pressure a long time ago. He had devoted considerable time to the question of economy of generation. In the Deptford station they adopted 200 lb. pressure 38 years ago. There had been a large amount of money spent on electric supply, but he did not see any alternative to what was being done at present. In 1910 they put down at one of the Vickers works in Sheffield a 3,000-kW machine, 1,500 r.p.m. They only had a 200-lb. pressure, but they had one stage of re-superheating to 750 deg. F., the l.p. steam being at about atmospheric pressure. They then introduced a steam regenerator between the condenser and the turbine exhaust, and also went in for four stages of progressive feed heating, which obviously involved air heating. All these things were embodied in the 3,000-kW plant. They found afterwards that there was a serious steam leakage owing to the construction of the machine. He had found no solution for the problem of re-superheating, which he considered satisfactory. The New York Edison Co. in its latest station had not adopted re-superheating. It had adopted regenerative feed-water heating, but it had only gone in for 375 lb. boiler pressure. He was very much surprised at that.

Mr. HENMAN said the system of re-heating by the use of oil had great future possibilities, and one of its big advantages was that it required smaller pipes.

Mr. R. B. MITCHELL, Glasgow, felt that the day would come when base-load stations would have a working pressure all through of something like 1,000 lb. at least. He suggested that a case had been made out for a combined plant consisting of some stoker boilers and some pulverised-fuel boilers.

Mr. POTTER, of Messrs. Simon-Carves, Ltd., said it was generally admitted that the grit from the pulverised-fuel chimneys was much finer and there was no nuisance through the emission of the grit.

Mr. ROLES, replying, said that unless they were going to deal with basic loads it would not be economical to put in a very highly-efficient plant. The point was that the matter had been dealt with by the Coal Conservation Committee. There had been no Committee set up to consider the question of the conservation of capital. In America, probably due to the fact that the undertakings were in the hands of companies and not municipalities, they had developed rather faster than we had done. Municipal Committees should consider the question of development and pioneering.

Ald. J. A. G. BEAUMONT, St. Marylebone, in moving a vote of thanks to Mr. Roles, said he was hopeful that some day he might hear a paper read by someone who would be able to show that as new ideas increased capital costs decreased.

The I.M.E.A. Exhibition.

(*Continued from page* 905.)

The JACKSON ELECTRIC STOVE CO., LTD., exhibited a complete range of eleven domestic cookers for families of from two to fourteen persons. It is interesting to note that there are 20,000 Jackson cookers on simple hire in this country, and that this make is exclusively to be offered on simple hire by the Buxton Corporation. A breakfast cooker specially designed for hire purposes was shown, as were also immersion heaters designed for use in existing hot-water tanks and cylinders.

Wash boilers of various designs, including a new model which is specially designed to eliminate dirt traps, with a japanned steel outer case and a tinned copper interior, were included in the exhibit. A feature was the "Perco-Wash" device which is designed for use with wash boilers to clean clothes by percolating action. Other items on this stand included a new type of fire with plug-in elements, specially designed for hiring purposes, and a water heater with a low continuous loading controlled by a thermostat. This is heavily lagged and designed to meet the increasing demand for this class of apparatus.

On the stand of MESSRS. MOORWOODS, LTD., in addition to the "Moorwood" electric cooker, was a range of attractive

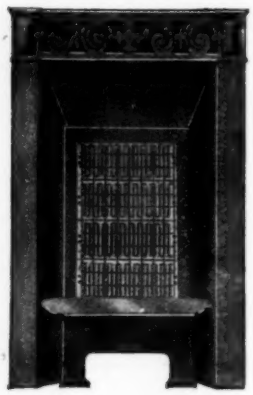


Fig. 6.—Moorwood Electric Fire.

Fig. 7.—New "Creda" Cooker.

electric fires. Fig. 6 shows one of the exhibits, which is specially designed for fitting in any room in place of the coal fire.

The principal features of interest on the stand of MESSRS. CREDENDA CONDUITS CO., LTD., were to be found in a range of "Creda" cookers. Included was a new model, C.43, fig. 7, which has an oven 12 in. by 9½ in. by 9½ in., and a hob containing one of the new "Creda" patented enclosed boiling plates, 1,800 W, and a separate grill. The new "Creda" enclosed boiling plate embodies some special patented features making, it is claimed, for efficiency and long life. Nichrome spirals of unusual length and particularly low-current density are laid in china formers, and the whole are embedded in special non-hygroscopic and heat-conducting cement. The insulation is said to be particularly good, and all the plates are flashed at 2,000 V before dispatch. The plate is interchangeable with the "Creda" open-type appliance. The new model is made in sections, each approximately 8 in. by 4 in., two sections being employed to form the standard plate. One section only is on circuit for medium heat, thus enabling small cooking receptacles to be used economically. The shape of the plates permits two or more pots to be kept going in medium heat on the one section. The makers guarantee the plates for two years.

MESSRS. SANTON, LTD., exhibited a range of electric geysers in addition to a variety of connecting plugs and service boards and the "Santon" electric tank-belt. The last-mentioned device, fig. 8, is a simple apparatus for use in conjunction with an ordinary kitchen range hot-water system. It consists of a flexible metal belt with an asbestos-lined cover, which can be slipped over the tank and clamped in position

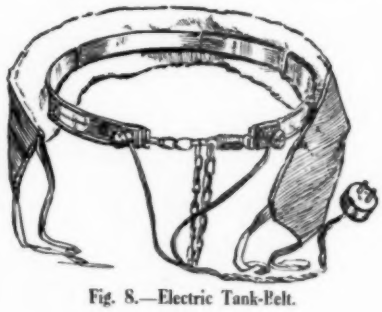


Fig. 8.—Electric Tank-Belt.

by means of a spring and chain attachment. It is supplied with 500-, 750- or 1,000 W loadings. It can easily be slipped up or down the tank as required, and two belts can be fitted and used together or separately. It is supplied complete with a length of flexible lead and a plug connection. The standard service board is fitted with two 30-A s.p. fuses and a rotary switch specially designed for heavy currents.

(*To be continued.*)

Reviews.

X-Rays, Past and Present. By V. E. PULLIN and W. J. WILTSHIRE, members of the Research Department, Woolwich. Pp. 229; figs. 43. London: Ernest Benn, Ltd. Price 12s. 6d. net.

The title indicates the wide and important field covered in the work by the authors, who are prominent members of the Radiological Research Department, Woolwich. The first four chapters are devoted to the early development and history of radiology; subsequent chapters deal with the application of X-ray methods to crystal lattice structure, spectroscopy and the practical applications of X-rays in surgery, medicine, and industry. The order of the subjects is well suited to the purpose of the book, and the authors write with evident experience of many of the difficulties of the subject.

When we consider that modern scientific resources enable us to enumerate with precision the constituent particles of an atom, and further to calculate the velocity of the particles and the ratio of their charge to their mass, we realise the romance of scientific investigation and the genius of the great investigators.

When a discovery of the first rank is made, the ultimate consequences always exceed anticipation. The X-ray was a discovery of this kind. At the time no one could have expected that these rays would provide us with a means of exploring the innermost secrets of atomic structure. Within a few years of their discovery, however, J. J. Thomson and Townsend had used the X-rays to convert air into an electrolyte, and had thus determined the value of the atomic charge, whilst later on Moseley and others, by the same means, had investigated the electrical constitution of matter with fertile observations and astonishing success.

The first aim of X-ray crystal analysis is to determine the classification of the atoms and molecules in the crystal unit, and to account for the properties of the crystal in terms of that classification. X-ray methods tell us directly the number of molecules in the crystal unit cell and the mode of their arrangement with such determination of length and angles as are required to define the structure completely. During the early history of the X-rays, the development of apparatus for their production was chiefly influenced by the requirements of medical radiologists; more recently the application of X-rays in physical research has become of outstanding importance. The analysis of a beam of X-rays into its constituent radiations by reflection at a crystal face provides a means of obtaining radiation of definite wavelength, and of such intensity as to enable its absorption coefficient in different materials to be measured with accuracy. Ingenious X-ray methods of qualitative analysis have been devised, exhibiting extraordinary delicacy and sensitiveness whilst dealing with infinitesimal quantities of matter. Industrially X-ray methods are finding increased application in metallurgy, consequent on the classical researches of Bragg, Ettisch, Polanyi, and others on the structure of metals, alloys, and steels. These methods are no longer of purely scientific interest; they are now utilised in several industries, including papermaking, explosives manufacture, and the leather, tanning, and textile industries.

The chapter dealing with the "Application of X-Ray Spectroscopy" is highly instructive. It contains an account of how Lane's inspiration and Professors Sir W. H. and W. L. Bragg's manifold applications of the method have already proved of the greatest practical value, not only in the advancement of scientific knowledge, but also in their application in several industrial and manufacturing operations.

As already pointed out, the book is intended for the layman, and is consequently not sufficiently detailed to be of special service to the expert. The volume is intentionally more or less elementary in design and is written to form an introduction to, rather than to supersede, standard works on the subject. It is, however, well suited for the purpose in view, and on the whole the book is probably the best available in its own particular line. The value of the descriptive matter is considerably enhanced by numerous illustrations, but the volume is practically devoid of references to the original work which has been consulted. The skill with which the authors have evaded mathematical difficulties and complexities allows one to recommend the volume as an interesting and generally accurate *aperçu* for the general reader.

History of Radio-Telegraphy and Telephony. Written and illustrated by G. G. BLAKE, M.I.E.E., A.Inst.P. Pp. xix+425. London: Radio Press, Ltd. Price 25s. net.

Nearly all books on radio communication contain a historical summary, but Mr. Blake has given us a really comprehensive historical treatise. The book is arranged essentially for reference as opposed to arm-chair study, but much of it is written so interestingly as to fit in with the latter form of reading as well.

There are 1,125 references to books, papers, patent specifications, &c. These references appear in the text as numerals which refer to a table of titles at the end of the book. There are also an excellent index and full chapter headings, and, in fact, for purposes of reference the book could not be better arranged. The general production, printing, and illustrations are first class.

This book is intended "to be a history of principles and invention rather than a record of commercial wireless," and the author's aim is "to bring into prominence almost forgotten schemes and devices in the hope that new ideas may spring therefrom."

The aim of the book may thus be taken as accounting for some apparent anomalies which would otherwise give grounds for criticism. For instance, we notice that the index contains more references to the author's own work than to that of Mr. Marconi, and again, far more space is given to inventions and suggestions which have proved of no commercial value than would have been the case in a strictly historical treatise. No outstanding practical work, however, has been omitted so far as this country is concerned, but it is impossible, as the author says, to make mention of all who have contributed to the development of radio communication. Developments in other countries are naturally dealt with less fully, but, remembering the author's aim, we consider that they are dealt with adequately, though, indeed, in describing theories of the upper atmosphere, Prof. Kennelly's name might well have been mentioned.

We are glad to see that the great pioneer work of Hughes receives full recognition, usually lacking in histories of radio, and in more recent times the work of Professor Eccles.

The book is full of interesting historical facts not realised by many recently recruited experimenters, such as Mr. Marconi's prediction in 1903 of radio communication with Australia, its realisation as long ago as 1918, a reference to piezo-electricity by Theophrastus in 300 B.C., the fact that the Eiffel Tower has been transmitting radio time signals for 17 years, and that telephotography over land lines has been in use for 23 years. These few extracts taken at random, in conjunction with the fact that there are 1,125 references, will help to give some idea of the thoroughness with which the author has dealt with his subject, and we have no hesitation in saying that his book will be found of great interest and value to every one who is engaged in the technical development of radio communication.

High-Frequency Electric Furnaces.

Prof. Ribaud's Experimental High-Temperature Equipment.

WITH the object of producing high-frequency electric furnaces capable of attaining a temperature of 3,000 deg. C., and permitting material under treatment to be easily removed or pyrometrical examinations to be conducted without being inconvenienced by smoke or fumes, Prof. G. Ribaud, of the Institut de Physique of Strasburg, has for some time past been conducting experiments with various forms of industrial

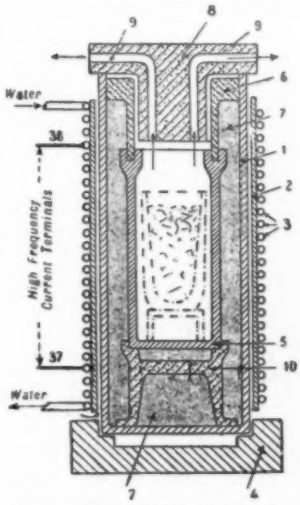


Fig. 1.—"Ribaud" High-Frequency Furnace.

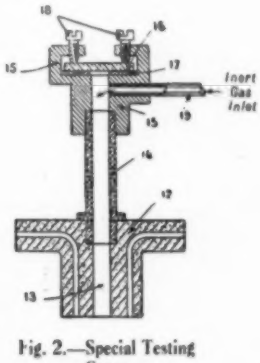


Fig. 2.—Special Testing Cover.

porous carbons. Such carbons, when composed of fairly large particles and also slightly agglomerated, are only slight conductors of heat and electricity, and are able to withstand temperatures exceeding 3,000 deg. C. On the other hand, by reason of their high porosity, they are combustible, and when red hot cannot be allowed to long remain in contact with air. At the same time their thermal conductivity is so low that the cover of the furnace, with the internal temperature referred to, which can be attained within three minutes, can be removed by hand. Fig. 1, reproduced from the *Journal de Physique et le Radium*, shows one of Prof. Ribaud's experimental furnaces. Its

essential components are an insulating cylinder made of melted quartz or other insulating substance capable of withstanding the high temperature, and a cylinder 2 on which is mounted the winding 3 for the high-frequency current, this winding taking the form of copper tubing. The two cylinders 1 and 2 are mounted on a base 4. The graphite crucible 5, heated by the induction, is prolonged at the upper end by a porous carbon cylinder 6, the outer surfaces of the crucible and the carbon being heated through the medium of the soot packing 7. The cover 8 is made of a piece of porous carbon, in which passages 9 are formed to act as outlets for the gases. The crucible rests on a piece of porous carbon 10, which is shaped so as to render it a poor conductor of heat.

The idea of making the external electrical winding of copper tubing was to enable water to be circulated through it, while in the course of experiment it was found necessary to extend the winding well above and below the crucible in order to keep the walls of the furnace as cool as possible, and so prevent burning. In order to reduce as far as possible any unnecessary increase in the self-induction, the source of high-frequency current was not connected to the extremities of the winding, but at the points marked 36 and 37. The outer cylinder is fixed at such a height above the base as to permit air to circulate between the two cylinders and so facilitate the cooling.

In furnaces in which it is desired to make pyrometrical tests the special cover shown in detail in fig. 2 is used in place of the cover 8 (fig. 1). In this case the cover 12 is provided with a central hole 13, in which is mounted a hollow extension piece 14 of porous carbon or other refractory material. This is surmounted by a special metal piece 15, in which is fitted a glass 16 supported on an elastic washer 17, and secured by two screws 18. A lateral tube 19 enables inert gas to be led into the inspection chamber and so drive from the latter any smoke that might detrimentally affect the inspection tests.

In furnaces of the Ribaud type the heating rapidity and the attainment of maximum temperature depend, of course, on the dimensions of the furnace and the available high-frequency power. For a furnace with a fixed interior capacity the heating-up speed is greater as the thickness is reduced. The maximum temperature attainable depends on the amount of available current, the consumption increasing at a greater ratio than the rise in temperature. Thus, in the case of a furnace with an interior volume of 100 cu. cm., while about 2 kW is necessary to give a temperature of 2,000 deg. C., approximately 7 kW is required to give 3,000 deg. C. With an available power of 10 kW the maximum temperature reached with graphite has been in excess of 3,000 deg. C. in the case of a furnace of a volume of 100 cu. cm., 2,500 deg. C. with one of 500 cu. cm., and 1,800 deg. C. with a 3,000-cu. cm. volume furnace. On a loading of 18 kW a temperature of 2,300 deg. C. has been reached in a 3-litre furnace, and 2,000 deg. C. in one of 5 litres capacity. As compared with a carbon-resistance furnace such as is used in the National Physical Laboratory in England, in which a temperature of 1,700 deg. C. can be attained in a 500-cu. m furnace on a consumption of 10 kW, Prof. Ribaud claims to be able to attain a temperature of 2,000 deg. C. in a furnace of similar size and with the same power.

Electrical Calculator Charts.

Two Charts devised by the electrical staff of Messrs. J. Lyons & Co., Ltd., for easily ascertaining motor loadings and cable volt-drop.

IT is often necessary to know the current taken by motors of varying h.p., and also to ascertain easily the voltage drop for a given length and size of cable, and in this connection the charts reproduced below, which have been prepared by Mr. Gordon Douglas, assistant electrical engineer, and Mr. A. B. Shirley, of the Electrical Department of Messrs. J. Lyons & Co., Ltd., for use in their own works, should prove interesting to many engineers.

By means of the chart, fig. 1, the current required by any motor of from 1 to 150 h.p., working at 90 per cent. 80 per cent., 72 per cent., and 64 per cent. efficiencies on either d.c., single-, two- or three-phase circuits can be directly read. The h.p. at the various efficiencies is found on the horizontal scale, the current in amperes on the vertical scale and the supply voltage and system on the curved scale. A transparent cursor (not shown), on which a central hair line is engraved, is pivoted at the point of origin. In order to find the current required by a certain motor, set the cursor with the line passing through the voltage of the supply system on which the machine is to operate, and find the h.p. at the desired efficiency on the horizontal scale. By looking down the chart to the cursor line and then along from this point to the current scale, the result in amperes is found. Similarly, if the h.p., current, and voltage of a motor are known, the efficiency of the machine can at once be obtained by

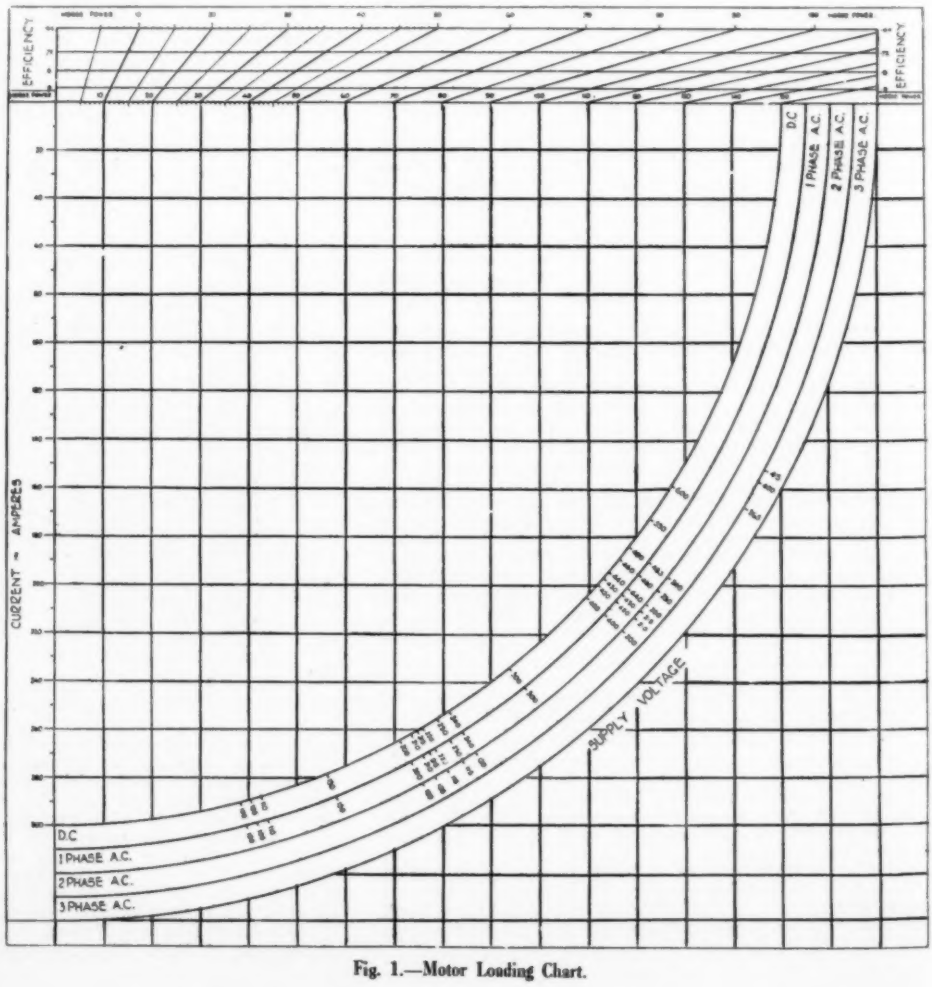


Fig. 1.—Motor Loading Chart.

reversing the method of reading.

With the volt-drop chart, fig. 2, it is easy to ascertain the drop per 100 yards run direct, not lead and return, for any size of cable from 1/.036 to 127/.103 carrying any current from 0 up to 150 amperes on d.c. single- or three-phase circuits. The size of cable is found on the horizontal scale, the current in amperes on the vertical scale, and the drop per 100 yards run of cable on the curved scale. A cursor similar to that used with the other chart is provided. To find the volt-drop the cursor is set so that the line passes through the point of intersection of the horizontal and vertical lines from the current and cable-size values, and the drop per 100 yards run is read off the curved scale. By reversing the method of working, the size of the most suitable conductor to carry a given current at a predetermined volt-drop may also be found.

For the sake of obtaining open scales in each case three columns are provided in colours, but to facilitate re-production these are shown blank.

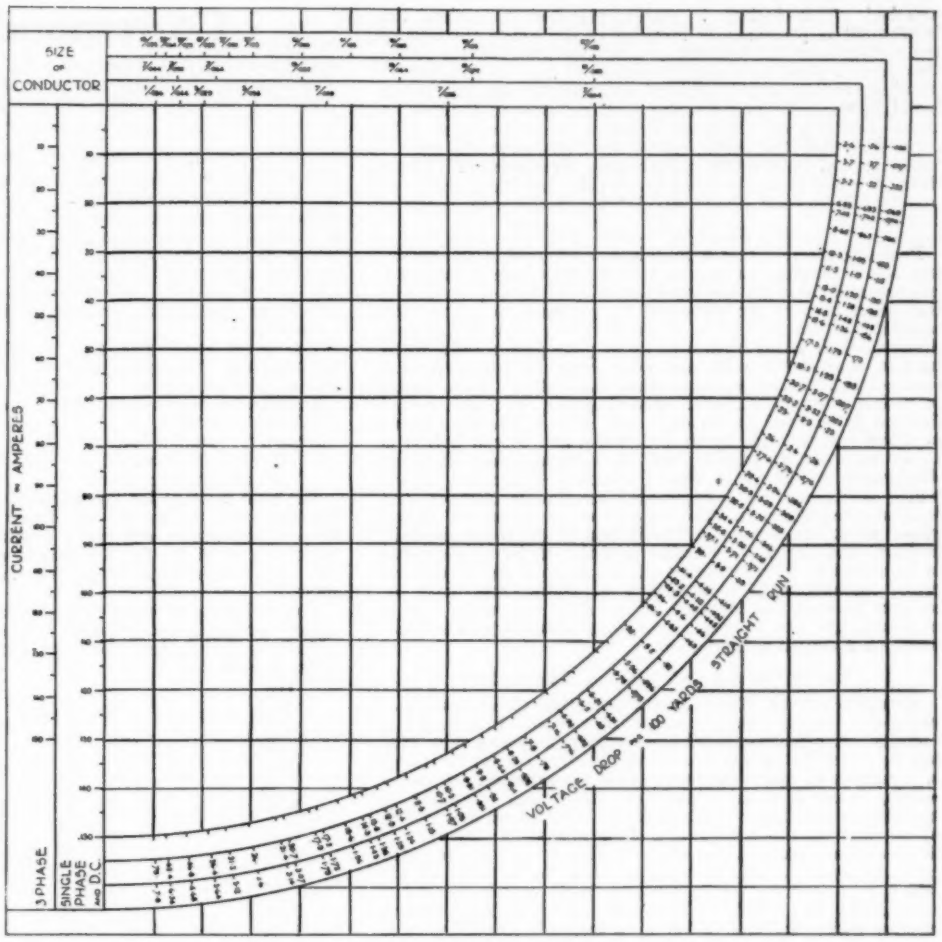


Fig. 2.—Cable Volt-drop Chart.

Selected Radio-Telephone Apparatus.

Recent Developments and Improvements.

A New Portable Receiver.

The reputation of their standard apparatus is sufficient recommendation for any new product of MESSRS. BURNDEPT WIRELESS, LTD., who recently placed upon the market a new receiver that can not only be termed truly portable, but is also well suited for permanent home installation. The three batteries are totally enclosed in the polished oak cabinet, which is provided with a carrying strap, their weight being equally distributed in order to facilitate carriage; a 2-volt, 20-amp.-hour "Exide" S.P.7 unspillable accumulator is employed to heat the filaments, together with dry-cell grid-bias and 108-volt anode batteries. The five valves, two of which are h.f. and two l.f. amplifiers, are of the low-consumption class, and the speaker incorporated in the set is provided with a contorted horn no less than 3 ft. 2 in. in length, constructed on the exponential principle; it terminates behind a grill, as indicated in fig. 1, which also shows that the top front portion of the cabinet hinges upwards to give access to the three controls: a single geared tuning-condenser dial in the centre and a volume (reaction) knob on the left, the switch on the right having a threefold purpose: in the top position it allows of normal broadcast-wave reception, and in the bottom position it permits of the longer-wave stations being heard, while in the central position it disconnects all batteries. The pair of terminals on the extreme left is for the connection of an external loud-speaker, if desired, and the pair on the right for the use of an external aerial and earth connection, although the set normally operates with an enclosed frame aerial wound round the inside of the cabinet. The latter is 18 in. wide, 17 in. high, and 8 in. deep, its back being hinged to form a door to give access to the valves, &c. Fitted to one side of the cabinet are two sockets which are connected to the internal accumulator; should it be required to operate the instrument in one particular place for any lengthy period, a larger capacity external accumulator may be connected to these sockets without removing the internal accumulator, or the sockets may be used for re-charging the internal accumulator without the necessity of removing it from the instrument, and a row of terminals is provided internally, although easily accessible, to which larger capacity dry batteries or a mains unit may be

Fig. 1.—The New Burndept Portable Receiver.

attached. This facility is particularly desirable when the instrument is permanently installed in the house throughout the winter months. The set is primarily intended for reception from Daventry within 200 miles of that station, but it should generally enable several Continental stations to be heard in Southern and Eastern England also, in addition to those operating on the lower broadcast wave band, so that there should be few places where the instrument will fail to make several alternative programmes available. A recent demonstration in a far from favourable location created an excellent impression of the capabilities of this new receiver.

An "Amplion" Cone Speaker.

Realising the fact that a considerable number of the receiving sets at present in use in this country are inherently incapable of operating certain types of cone loud-speaker, and that their owners are reluctant to purchase new receiving apparatus, MESSRS. GRAHAM AMPLION, LTD., have deliberately designed their latest models so as to give good results when used in conjunction with any good receiving set of normal construction. As an example their AC.5 type cone, which is visible through an open fretted grille, is "old gold" finished in contrast to the dark oak cabinet, the dimensions of which are only 15½ by 6½ in., whilst the overall height is 14 in. The electromagnetic unit is adjustable and the cone diaphragm is made of a strong seamless fabric, not paper, which is claimed to be impervious to climatic changes and temperature variations. The absence of the so-called "megaphone effect" is due to the elimination of the sound conduit, or horn, and one of the peculiar qualities of the cone speaker is its capability of reproducing the lower notes in the musical scale; manufactured in a variety of styles, this make of speaker obviates the necessity for a special or unusual design of circuit, and the sample lent us for trial functioned satisfactorily on a simple receiving set.

The "Gecophone" Battery Eliminator.

An anode-battery eliminator for operating off domestic a.c. electricity supply mains must, of course, incorporate a rectifier. A recently-evolved type employs a special valve containing a rarified gas in which rectification occurs by means of a species of glow discharge, such an arrangement representing a considerable saving of the energy required to operate the eliminator; indeed, the valve possesses no filament at all, and its life is therefore independent of the risk of filament fracture. An example of this system is marketed by the GENERAL ELECTRIC CO., LTD. After rectification, which is full-wave, the percentage ripple remaining superimposed depends on the efficiency of the smoothing, or filter, circuit, which consists of a large reservoir condenser and choke coils having a large inductance, the resistance of the choke being kept as small as is consistent with reasonable cost. An interesting feature is the means by which the output voltage of the eliminator (*i.e.*, voltage applied to the anodes of the valves in the receiver) is prevented from

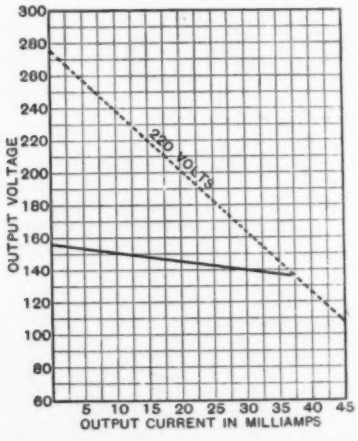


Fig. 2.—Battery Eliminator Characteristic "Curves."

falling very rapidly as the current taken from the eliminator increases; for example, if the anode current of any valve were changed, say, by altering the grid-bias voltage, the anode voltage would also change very appreciably. The accompanying characteristic "curves" were taken from a "Gecophone" eliminator attached to 220-volt a.c. mains; the dotted line shows the type of characteristic that would be obtained without the aid of the voltage regulator employed, from which it will be seen that as the output current increases from zero to 37 milliamps the voltage drops from approximately 280 to 150 volts, whereas with the voltage regulator in use the drop is comparatively small, being denoted by the slope of the thick black line. The regulator takes the form of a special "Osglim" neon lamp shunted across the output of the eliminator, and the important point is that on a multi-valve wireless receiver any grid-bias adjustments may be made, or valves substituted, with the knowledge that the anode voltage on each valve will remain constant.

Correspondence.

Correspondents should forward their communications as early as possible. *No letter can be published unless we have the writer's name and address in our possession.*

Energy Consumption in Small Houses.

Estimates of energy consumption, costs, &c., have been published from time to time in your pages, but so far as the writer recollects, there has been nothing which gives a fair indication of the consumption in a moderate-sized house which is not wholly "electric." The following average monthly consumption figures may be of use to contractors and others who are endeavouring to persuade possible customers to change over from gas to electricity for general purposes.

The house consists of two living rooms, three bedrooms, kitchen, and scullery. It is a modern semi-detached house costing £975.

The electrical equipment consists of:—

5.3-kW cooker.
2.0-kW portable fire.
.75-kW bowl fire.
Vacuum cleaner: iron.

The total wattage for lighting is 510. The 2-kW fire is used for occasional heating in the dining-room, such as breakfast time in the winter, and chilly evenings in spring or autumn. It is also used in the drawing-room in the winter, when the use of this room is required as well as of the dining-room.

The following average consumption is taken from daily meter readings, and is based upon the time the house is actually occupied, *i.e.*, allowance is made for holidays, week-ends, &c.:—

Date. 1926.	No. of days.	Units.	Average units per day.
March	31	168	5.42
April	27	134	4.96
May	31	138	4.45
June	28	138	4.92
July	29	102	3.52
August	27	104	3.85
November	30	169	5.63
December	31	191	6.16
1927.			
January	26	146	5.64
February	28	157	5.6
March	25	108	4.32
April	30	134	4.46
May	31	130	4.2

During the period under review, a total of 3 tons 12 cwt. of coal has been purchased. This is used only for the dining-room and kitchen. The number of residents in the house is two, but for about four months during this period an elderly relative has been living in the house also.

As only one meter is fitted, lighting consumption cannot be given separately, but this is estimated to be about 120 units. I trust these figures may be of use to readers of your paper.

A.M.I.E.E.

June 6th, 1927.

The Ideal Wiring System.

I have read with great interest the article and subsequent letters on the above subject. My reason for preferring steel conduit is because of the experience of a friend of mine, who had to re-wire a country house owing to rats having eaten away the lead sheathing and wiring too. Rats would have little difficulty in eating a way through rubber sheathing, but would find steel conduit a stiff proposition.

W. Garratt.

Bloxwich, *May 31st*, 1927.

Metal-clad Draw-out Switchgear.

I was very interested in the article on "Metal-clad Draw-out Switchgear" in your last issue.

Mr. T. Carter is evidently biased in favour of the horizontal type, which gives the impression that he, personally, is interested in its manufacture.

Might I point out that horizontal gear is no more British than the vertical type, although the author endeavoured to convey another impression? British ships of oak played an important part in our history, but our present-day Dreadnoughts are no less British, although the amount of oak used in their construction is a negligible quantity.

The author refers to metal-clad switchgear as "the ideal British standard and a pattern for the world to follow," but ideals and standards are apt to vary due to changing conditions, and I venture to prophesy that in a very short time the majority of the progressive firms will have decided in favour of the vertical type, however reluctant they may be at present to scrap existing designs and tools.

H. Whitehead.

Cardiff, *May 31st*, 1927.

Mr. Carter's article which appeared in a recent issue of the REVIEW contained many convincing arguments in favour of the horizontal type of metal-clad gear, as against the vertical type, and any further points which I may attempt to advance in favour of the horizontal type may appear to be superfluous. I would, however, like to avail myself of the opportunity of relating a recent experience.

A few months ago, I had occasion to witness a series of short-circuit tests on various sizes of oil circuit breakers. These tests were carried out by throwing dead short circuits across a 45,000-kVA turbo-alternator. It was proposed to determine the limit at which some of the smaller breakers would fail to clear, and during one group of tests one of the breakers interrupted two consecutive "shorts" with a two-minute interval. When, however, the breaker was closed on the "short" for the third time, the effect was surprising. The complete breaker became enveloped in a cloud of flame approximately 10 to 12 feet in diameter and rising 30 to 40 feet high. The heat was so intense that those of us standing within 25 or 30 yards of the pit had to move further back. When the flames were extinguished, one naturally expected to find the breaker completely wrecked. This, however, was not the case; the tank was still in position, and the top cover and enclosure were found mechanically sound (in fact, these parts were used for subsequent tests).

The most remarkable revelation was the small quantity of oil lost, since, although such a large volume of flame followed the breaker's attempt to clear the short, only a few pints of oil were actually missing from the tank. It should be noted that the breakers tested were reasonably flame-proof; in fact it was difficult to account for the emission of such a large volume of flame in such a short interval of time.

If the advocates of vertical-type metal-clad gear, having busbars mounted directly above the oil circuit breaker, had an opportunity of witnessing such oil-circuit-breaker tests, they would undoubtedly insist on having gear in which the busbars are mounted as far as possible away from the top of the breaker, *i.e.*, as they are on the horizontal draw-out type. Moreover, they would hesitate before installing vertical-type gear, with oil-filled busbars, directly over the breaker.

Mr. Carter condemns a design in which connections from the main and auxiliary busbars are brought into a common circuit-breaking tank. Such an arrangement could be incorporated in the horizontal type of gear, just as easily as in the vertical type. It is doubtful, however, whether responsible engineers and manufacturers will be persuaded to jeopardise their designs by introducing a feature so contrary to established circuit-breaker practice. The effects produced by a breaker interrupting a large short-circuit current are now fairly well known, and one can only have very grave doubts regarding the efficiency and soundness of the second breaker after the first has operated under fault conditions. This, in effect, would be equivalent to the operation of one breaker on a fault putting two breakers out of commission.

Horizontal draw-out metal-clad gear (with compound-filled busbars) has stood the test of time, and it is significant that the supply undertakings which have had the most experience with metal-clad gear are refusing to change over to a new style. Novel ideas are always attractive, and may be sound, but their success requires a very keen imagination to predict all the conditions and combinations which are likely to be encountered in the future. The horizontal type of gear has long since passed through the experimental stage, and if, during the last 20 years, it had failed to meet all the conditions of service, it would not have reached its present unassailable position in the switchgear world.

D. R. Davies.

Manchester, *June 6th*, 1927.

A Mysterious Occurrence.

In answer to Mr. Hinsley, I do not think that his is the correct solution, as there was no sign of any creeping along the cables, at either the switch or transformer end of the cables. Further, each cable was covered with a film of white dry dust.

The h.p. cable is a 3-core armoured one, and is not old, having been installed new in 1923; the cores are separated before entering the transformer.

The l.p. cables are v.i.r. type, also new in 1923.

On leaving the transformer, all the cables rise upwards above the top of the transformer. The connections are made above the oil level; the ends of the cables are sweated into lugs and bolted to the lugs of the transformer coils.

June 4th, 1927. **W. H. M.**

Single-phase Induction-Motor Starting Devices.

Mr. G. Windred, by his article in your issue of June 3rd, would appear to be hopelessly out of date on this subject, as quoting from his article will show: "and to describe briefly a starting arrangement giving greatly superior characteristics to any of those at present in use" . . . "It is evident that the arrangement has not obtained the sphere of use in this country which its superior characteristics warrant, and it is with the object of bringing the arrangement to the notice of the engineers concerned that the present article has been written, giving, in the author's belief, a description of the method and its application hitherto unpublished in this country."

I have before me a copy of "Electric Motors" by H. M. Hobart, which I purchased 17 years ago, and which on page 614 describes, exactly, what your contributor calls the Ferraris-Arno method; it also states clearly that the author, H. M. Hobart, in co-operation with C. S. Bradley, carried out tests on this system in the year 1893. The book also quotes an article from the *Electrical Times* for December 13th, 1905, page 855, giving particulars of factories running two-phase motors from a single-phase supply and a pilot motor, by engineers of the West Ham electricity supply station, higher efficiencies and higher starting torque resulting from this. The article concludes as follows: "The idea is also described in Ferraris and Arno's B.P. 7504 of 1895," but, as already stated, the arrangement was proposed and tested at Lynn, U.S.A., by Bradley, in 1893.

W. S. Daniels.

Leeds, *June 4th*, 1927.

The Preservation of Historical Electrical Plant.

I believe I am correct in saying that many of the older locomotives which took part in the 1925 Railway Centenary celebrations owe their preservation to chance. They remained, in some cases, almost forgotten in sheds and sidings, until the flight of time gave them a value which was suddenly realised, and to-day they could not be bought for mere money.

There is not much hope of this kind of thing occurring in the electrical industry, however; sites are restricted and ground space is valuable, so that old plant is ruthlessly scrapped to make room for new.

These conditions render it impossible that a chief engineer of, say, the year 1950, will be able to make the discovery that the strange-looking machine, perhaps the pride of the station at the time of its building back in the 'nineties, but now dirty and neglected in a remote corner of the station, has a value which has passed from the local to the national.

One goes to the Science Museum at South Kensington and sees the history of electrical generating plant represented in very meagre fashion. Some of the early experimental apparatus is to be found, it is true, but of commercial types down to the present day, practically nothing.

Yet during the last few years many old generating sets have been advertised for sale in the ELECTRICAL REVIEW, and these have doubtless all gone "under the ball." Siemens, Ferranti, Crompton, and Mordey alternators, types never to be seen again, but important in the history of electricity generating plant, have been going one by one, until now their numbers must be small in the land.

Similarly, too, many old switchboards, Manchester and Ferranti types for example, must have been broken up, and soon none will exist, if they have not all gone already.

In your current issue we read that at Deptford "the pioneer high-voltage plant of the world . . . the last two original Ferranti generating sets are now being dismantled, and the remaining historic Partridge switchgear will soon be displaced." The sending of these relics to the junk merchant will, in the writer's opinion, be an act of vandalism which later generators will find it difficult to excuse. Every effort should therefore be made, either by individual or joint action, to prevent this occurring, and to preserve these links with a past, which, although recent in number of years, yet is remote when measured by standards of progress.

In conclusion, your readers may have observed, during recent months, references in the newspapers to the passing of the old Brighton locomotive "Gladstone" to preservation in the Railway Museum.

Where is the electrical industry's museum, or has this industry less soul than the railways?

Ernest F. Smith.

Dunfermline, *June 4th*, 1927.

Cheap Electricity.

My letter on this subject, which appeared in your issue of April 29th last, has been a little misconstrued, as my object was not in any way to be personal or to attack anyone, but rather to draw attention to the great difficulty there is in refuting the arguments put forward in favour of the small independent plant. This trouble is largely due to the fact that it is not easy to include *all* the items of cost. Still I realise that in my hurry I did not express myself quite as I should, in reference to your correspondents; I must therefore apologise to them for my writings not having properly conveyed my intentions. I fully appreciated that Mr. Mountain's paper was written as a counterblast to the Electricity Bill. Mr. Mountain had told me that Messrs. Ruston and Hornsby had asked for a number of copies of his paper for distribution, and I understood that also a suggestion had been made to redraft and republish it. Hence I wrongly assumed that this new publication was the edited copy.

Shortly after writing my letter, I received closer information than that now given by Messrs. Ruston & Hornsby, Ltd., as to who had actually compiled the pamphlet. My opinion is, and was, that the data contained in both pamphlets are to be thoroughly relied upon as regards the accuracy of the figures quoted, for the authors are both authorities. The

point I wished to make was the great difficulty of including *every* cost, so that a figure might be arrived at, that would enable current to be supplied profitably to another independent party. I have been associated with the installation of a number of Diesel plants and consider that there is a very big field for them—but not in the area of a properly organised central station supply. I happened recently to be looking at a map which showed the electricity supply areas of this country, and in discussing one of them with a prominent engineer, he casually remarked, apropos of one public electricity supply station, "That works will of course have to be closed down, when the mains reach that town, as it is a Diesel station." Verb. sap.

R. Borlase Matthews.
Wh.Ex., A.M.Inst.C.E., M.I.E.E., F.R.Ae.S.

East Grinstead,
May 30th, 1927.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

The Department of Overseas Trade.

Viscount ELIBANK has given notice that he intends, on June 16th, to call attention to the proposed termination of the separate existence of the Department of Overseas Trade and to move a resolution urging the Government to reconsider the proposal and retain the Department in its present form.

The Whitsun Recess.

The House of Commons rose for the Whitsuntide Recess on June 2nd, and will reassemble on Monday, June 13th. Mr. BALDWIN, the Prime Minister, announced on June 1st that it would be impossible to prorogue the Session in the summer, as had been hoped, and to start a new session in the autumn. He now hoped that it would be possible to adjourn at the end of July for the summer recess, and to continue the present session in the autumn.

Key Industry Duties.

On May 31st, Sir P. CUNLIFFE-LISTER, President of the Board of Trade, presented a statement showing the value of the goods upon which key industry duty was paid in the periods January-April, 1926, and January-April, 1927, respectively. This included scientific instruments, gauges and measuring instruments of precision, £34,620 and £48,326; wireless valves and similar rectifiers and vacuum tubes, £57,488 and £44,393; ignition magnetos and permanent magnets, £16,438 and £11,545; arc-lamp carbons, £9,343 and £6,973; and metallic tungsten, ferro-tungsten, manufactures of metallic and rare earth compounds, £5,760 and £13,636.

Breaking-up of Streets.

On June 1st, Sir R. THOMAS asked the Minister of Transport whether any steps were being taken towards unification of working among the various Metropolitan authorities controlling electricity, gas, water, and any other services which involved the laying of pipes and cables, with a view to reducing to a minimum the public inconvenience caused by the continual breaking-up of the streets.

Colonel ASHLEY said that his powers under Section 4 of the London Traffic Act, 1924, with regard to the control of the opening of streets in the London Traffic Area by public utility services were limited. Those undertakers, however, voluntarily supplied his Department with a considerable amount of information as to any street works of importance which they contemplated carrying out, and every effort was made to co-ordinate them with other street works as far as was reasonably practicable.

London and Home Counties Electricity (No. 2) Bill.

The Committee of the House of Commons which is considering this Bill, continued its proceedings on May 31st. During the day evidence was given by Sir John Snell (Chairman of the Electricity Commission) as to the attitude of the Commissioners towards the proposal to erect a station at Chiswick, in view of the London Power Co.'s proposal to erect another large station at Battersea (about five miles from Chiswick). The view of the Commissioners was said to be that both stations would be necessary if future demands were to be met.

Evidence was given on behalf of various rowing clubs which use the part of the river near the Duke's Meadows site, in opposition to the Bill, and the Committee adjourned until after Whitsuntide.

Yorkshire Electric Power Bill.

It is reported that this Bill, which has passed the House of Lords, is to proceed through the House of Commons as an unopposed measure. The Bill empowers the Yorkshire Electric Power Co. to raise a further £2,000,000 in share capital and £1,000,000 in loan capital. It also authorises the board to borrow to the extent of one-half instead of one-third of its existing authorised capital of £4,000,000.

Legal.

Hart Accumulator Co., Ltd., v. Berton & Onions.

IN the Bow County Court on May 30th, before Judge Snagge, the Hart Accumulator Co., Ltd., sued H. A. Berton and A. H. Onions, trading as the D.A.S.H. Wireless Service, Birmingham, for £10 5s. 3d. for goods supplied.

Mr. ATKINS, for the plaintiffs, said that the claim was for electrical and wireless goods supplied in November, 1926. Mr. Berton, one of the defendants, had made an affidavit stating that at the time the goods were ordered he was no longer a member of the D.A.S.H. Co., having dissolved partnership on June 10th. The dissolution was advertised in the *London Gazette*, which was sufficient to release him from any liability. Mr. Atkins submitted that a notice should have been sent to every firm with whom they had been trading. Mr. Onions had not appeared, and judgment would have to be entered against him, even if his Honour was against the plaintiffs as to the liability of Berton. His clients had received the order for the goods on D.A.S.H. Co. paper, with the names of the two alleged partners still on it, and no intimation had been received that Berton was no longer a partner.

Mr. GALLOP, for Mr. Berton, submitted that his client knew nothing whatever of the transaction, and said that the plaintiffs had no right to presume that Berton was a partner in November, and they therefore had failed to make out a *prima-facie* case.

Judge SNAGGE, in giving his decision, said it was an interesting point as to whether publication in the *London Gazette* was sufficient, but he was bound to come to the conclusion that the plaintiffs had not established a *prima-facie* case that Berton was a partner and liable, and therefore in his case there would have to be judgment for him with costs, but he would enter judgment for the plaintiffs for the full amount claimed against Onions, with costs.

Reid v. Dalrymple.

THE *Railway and Tramway Journal* reports that in the Court of Session recently, Lord Murray fixed the first week in July for the trial of the action by Councillor Reid, a member of the Glasgow Town Council, for slander, against Mr. James Dalrymple, the late general manager of the Glasgow Corporation tramways.

Aberdeen Suburban Tramways Co. v. Aberdeen Town Council.

THE First Division of the Court of Session has recalled the interlocutor of Lord Moncrieff in the action by the Aberdeen Suburban Tramways Company against the Aberdeen Town Council for payment of £26,800 for loss and damage to the pursuers' tramway track caused by the defenders' operations in connection with a new aqueduct, and assoilzied the defenders from the conclusions of the action with expenses. Their lordships took the view that the action was barred by Section 8 of the Aberdeen Suburban Tramways Confirmation Order Act, 1902, which provides that the Corporation (the defenders) shall not be liable for any damages the company may sustain through the acts of the Corporation—through the reasonable exercise of any rights, functions, powers, or privileges, vested in the Corporation, except in so far as such damage may be due to the fault or neglect of the Corporation.

The Danish Electrical Industry.

MR. H. KERSHAW, O.B.E., Commercial Secretary at Copenhagen, has submitted a report upon the economic situation of Denmark (dated February, 1927) to the Department of Overseas Trade (Stationery Office, 1s. 6d. net). In a general survey, Mr. Kershaw states that Denmark is slowly recovering from the effects of deflation, but is still confronted with serious social and industrial problems, one of the chief of these being the heavy burden of taxation. There is a widespread movement in favour of British goods, Denmark wishing to retain this country as her best customer; but British exporters must recognise the special conditions of the market. The national independence of thought necessitates intensive advertising, which means that higher commissions have to be paid to agents.

Electrical Production and Imports.

Denmark holds a strong position in the range and quality of her electrical products and, except in the case of heavy machinery for generating stations, would enjoy a larger measure of independence in the matter of imports if manufacturers could bring down their production costs. The constant overhauling of the numerous power stations and the construction of new ones provide good openings, but British prices, though more favourable now than for many years, were too high in the case of recent contracts. German, Swiss, and partly Swe-

dish machinery is still considerably cheaper. The Danish electrical industry consists of about 55 factories, employing 6,000 hands. During 1926 there were produced 278 dynamos, valued at kr. 1,374,000 (kr. 18.2 to the £); 455 transformers (kr. 573,000); and 26,770 motors (kr. 9,700,000). The imports of electrical machinery in 1926 were 809 metric tons, valued at about kr. 4,000,000. About a third of these consisted of vacuum cleaners of German, Swedish, and Canadian origin. Germany and Holland dominate the lamp trade, notwithstanding the efforts made by the Danish manufacturers. In porcelain fittings German producers have again started to compete very severely with Danish firms, and as regards insulating materials, in addition to German and Italian firms, British manufacturers have entered the market with excellent qualities at competitive prices. British firms have also improved their position in the supply of switchboard material, pyrometers, and certain other special instruments, but a few other foreign firms have been successful in countering the price-cutting by the Danish cable and wire works. There is an opening for good-quality enamelled wire. Notwithstanding German competition, British accumulator makers have made a certain amount of progress. To avoid a higher rate of duty, German makes are imported in parts for assembly. For large power station batteries Germany still leads, but British portable types are gaining over the American and German makes. There is little to be done in primary batteries. In 1926 Denmark produced (or assembled) 325 metric tons of portable accumulators, valued at kr. 684,000. The total production of primary cells amounted to 2,920 tons, valued at kr. 7,000,000, of which some kr. 6,000,000 worth were exported.

There are about 150,000 registered radio-receiving sets in Denmark, but an impetus is expected to be given to broadcasting when the new station at Kallundborg is completed. This station is being erected by a British firm. There are signs that the market is leaning towards quality goods, which may favour British products at the expense of cheap German and Danish goods. American sets, while good, are handicapped by their usual limitation to wave-lengths below 600 metres. Danish radio manufacturers are paying royalties up to 10 per cent. to American patent holders. The annual importation of radio apparatus, excluding batteries, is valued at about kr. 3,000,000 and the home production at about kr. 1,750,000. The Danish output of batteries for radio purposes is valued at about kr. 3,500,000 per annum.

Electrification.

The report states that most Danish agricultural undertakings have been electrified in spite of the fact that the power production is mainly by means of imported fuel. This has been accomplished by co-operation between the farmers themselves. Most of the electricity works are equipped with Diesel engine plant, and only the large factories and h.p. stations use steam turbines. A new 50,000-V cable, with a capacity of 17,000 kW, has been laid in the Oersund for the transmission of power between Sweden and Denmark, a distance of 135 km. It is said that this will result in the annual saving of about 25,000 tons of coal.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1925.

23,064. "Prepayment electricity, gas, and other meters." Chamberlain and Hookham, Ltd., and S. James. November 7th, 1925. (Cognate application 30,904/25.) (270,467.)

23,495. "Electric fuses." B. Hesketh. November 12th, 1925. (270,969.)

1926.

1,271. "Electric tumbler switches." A. B. Reeves and F. E. Minton. January 16th, 1926. (Cognate application 25,915/26.) (270,781.)

1,315. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and J. E. Ostline. January 16th, 1926. (270,782.)

3,474. "Control of apparatus at an electric power sub-station from a central control office." Automatic Telephone Manufacturing Co., Ltd., and C. Remington. February 6th, 1926. (Addition to 252,231.) (270,788.)

3,553. "Adjustable grid conduit boxes for electric switches." J. P. Annacker. February 9th, 1926. (270,792.)

3,842. "Telephone systems." Standard Telephones & Cables, Ltd. (G Deakin and L. Polinkowsky). February 10th, 1926. (270,794.)

3,951. "Apparatus for converting alternating current into unidirectional current." R. S. Atherstone. February 11th, 1926. (270,797.)

3,994. "Circuit arrangements for use with high-frequency currents." E. Green. February 11th, 1926. (270,800.)

4,015. "Radio-transmitting apparatus." Standard Telephones & Cables, Ltd. April 7th, 1925. (250,539.)

4,333. "Wave-distorting systems for electric signalling." Standard Telephones & Cables, Ltd. (Western Electric Co. Inc.). February 15th, 1926. (270,817.)

4,383. "Ringing arrangement for telephone systems." Standard Telephones and Cables, Ltd. (Western Electric Co. Inc.) February 17th, 1926. (270,825.)

4,835. "Steam-driven electric generating plant utilising exhaust steam for auxiliary purposes." International General Electric Co. Inc. February 21st, 1926. (247,984.)

5,042. "Container and handling means for storage batteries and the like." T. R. Palmer. February 22nd, 1926. (270,833.)

5,043. "Terminal assemblies for telephone exchanges." Siemens Bros. and Co., Ltd., and C. Lambert. February 22nd, 1926. (270,834.)

5,108. "Electric pushes." J. Sax & Co., Ltd., and J. E. Abbott. February 23rd 1926. (270,836.)

5,388. "Induction regulators." English Electric Co., Ltd., and W. E. M. Ayres. February 25th, 1926. (270,839.)

5,542. "Electromagnetic relays." Tyer & Co., Ltd., and J. W. Punter. February 26th, 1926. (270,843.)

6,298. "Electrically driven slicing machines." Berkel & Parnall's Slicing Machine Manufacturing Co., Ltd., and H. Thomas. March 6th, 1926 (270,854.)

7,154. "Quick-action electric switches." A. J. Veall. March 17th, 1925. (249,517.)

7,447. "Wireless apparatus." W. C. Butler and R. W. Angel. March 17th, 1926. (270,864.)

8,898. "Wireless telegraphy and telephony." Bowden Wire, Ltd., and A. H. Nisbett. April 1st, 1926. (Cognate application 22,573/26.) (270,871.)

9,590. "Method of and means for interrupting electric circuits." G. S. Marston. April 12th, 1926. (270,879.)

10,178. "Dynamo-electric generators." F. Kesselring. April 18th, 1925. (250,972.)

10,277. "Electric dryers." Eastern Laboratories Inc. April 28th, 1925. (251,612.)

11,081. "Insulating material for electric condensers and the like." J. Lahousse. May 8th, 1925. (251,970.)

11,615. "Electrode for medical purposes, particularly for use in diathermic treatment and process for the production thereof." Dr. E. Last. November 14th, 1925. (261,335.)

11,833. "Variable static transformers provided with a variable magnetic circuit." G. Burnengo. May 5th, 1925. (251,998.)

12,063. "Plug and-socket connectors." C. L. Arnold and M.K. Electric, Ltd. May 10th, 1926. (270,899.)

12,093. "Connection systems for telephone plants with automatic counting of the calls." Automatische Fernsprechanlagen-Bau-Ges. February 15th, 1926. (265,912.)

12,101. "Gasfilled electric lamps." Siemens & English Electric Lamp Co., Ltd., and P. D. Oakley. May 10th, 1926. (270,900.)

12,192. "Armouring for single-core alternating-current cables." Felten and Guilleaume Carlswerk Akt. Ges. June 13th. 1925. (253,496.)

13,084. "Electric conductors for signalling purposes." Felten & Guilleaume Carlswerk Akt. Ges. July 9th, 1925. (255,025.)

13,900. "Electrical resistances or rheostats." Morgan Crucible Co., Ltd., and C. C. Gow. June 1st, 1926. (270,908.)

15,111. "Variable condensers and like instruments." W. Rogers and Wingrove & Rogers, Ltd. June 16th, 1926. (270,914.)

19,784. "Thermionic and like amplifiers." S. Y. White. August 11th, 1925. (256,967.)

23,808. "Exhausting apparatus for the production of a high vacuum." E. W. Moss (Akt. Ges. Brown, Boveri et Cie.). September 27th, 1926. (270,947.)

24,972. "Automatic thermal circuit-breaker for an electric circuit." G. Maire. October 7th, 1925. (259,593.)

25,421. "Diaphragm sound-reproducers for wireless apparatus, gramophones, and the like." Ritter & Uhlmann Akt. Ges. October 15th, 1925. 259,966.)

27,485. "Armouring for single-conductor alternating-current cables." Felten & Guilleaume Carlswerk Akt. Ges. April 21st, 1926. (Addition to 259,536.) (269,842.)

27,713. "Armouring of electric cables." Felten & Guilleaume Carlswerk Akt. Ges. April 21st, 1926. (Addition to 259,536.) (269,843.)

27,829. "Mounting for the electrodes of closed electric furnaces." I. G. Farbenindustrie Akt. Ges. December 28th, 1925. (263,756.)

27,844. "Modulation systems applicable for wireless signalling." Marconi's Wireless Telegraph Co., Ltd. November 28th, 1925. (262,676.)

28,660. Magnetic separators." F. Krupp Grusonwerk Akt. Ges. November 14th, 1925. (261,410.)

30,188. "Electric ignition systems for internal-combustion engines." J. De Coster. December 5th, 1925. (262,420.)

30,980. "Wired radio transmitting system." Wired Radio Inc. December 23rd, 1925. (263,777.)

30,802. "Fluid-tight electric switch." N. Munthesen. December 4th, 1926. (270,980.)

1927.

529. "Electric heating units." British Thomson-Houston Co., Ltd. January 7th, 1926. (264,172.)

1,046. "Electric resistance annealing furnaces." Akt. Ges. Brown, Boveri et Cie. May 19th, 1926. (271,003.)

1,078. "Scales for radio vernier-control apparatus." C. Nehrke. June 29th, 1926. (271,004.)

1,615. "Method of and apparatus for navigating aircraft by wireless." H. Junkers. February 12th, 1926. (265,940.)

1,628. "Arrangements for feeding the filaments or incandescent cathodes of discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. January 29th, 1926. (265,183.)

6,978. "Containers for storage batteries and the like." T. R. Palmer. February 22nd, 1926. (Divided application on 270,833.) (271,019.)

7,946. "Electromagnetic acoustic apparatus." N. W. McLachlan. February 9th, 1926. (Divided application on 270,421.) (271,021.)

10,479. "Electric motors intended to work in an explosive medium." Ateliers de Constructions Electriques de Charleroi. April 19th, 1926. (269,592.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from June 1st. In the case of foreign applications, the names and addresses of the British representatives are also given :—

Duophragm. No. 477,742. Class 8. Telephone diaphragms.—Duophragm Syndicate, 92, Cannon Street, E.C.4.

Accuratune (lettering and design). No. 472,671. Class 8. Radio apparatus and parts thereof, namely, condensers, transformers, rheostats, variometers, vario-couplers, coils, grid leaks, antenna equipment, graduated dials, potentiometers and battery chargers.—Mydor Radio Co., Newark, New Jersey, U.S.A. (Hans & Danielsson, 121, St. John Street, E.C.1.)

System Zeiler (lettering and design). No. 476,351. Class 8. Galvanic cells, dry cells, dry batteries, refill batteries, and electrical accessories and parts.—Die Batterien & Elemente Fabrik System Zeiler Gesellschaft, Berlin. (Marks & Clerk, 57-58, Lincoln's Inn Fields, W.C.2.)

Spiovisor. No. 478,416. Class 8. Apparatus for use in transmitting views, scenes or images to a distance by telegraphy.—Television, Ltd., Motograph House, Upper St. Martin's Lane, W.C.2.

Zampa. No. 479,800. Class 8. Instruments and apparatus for use in connection with radio-telegraphy and telephony.—Mic Wireless Co., White Horse Place, Market Street, Wellingborough.

Domeno. No. 479,909. Class 8. Flash lamp batteries.—Runwell Cycle Co. (London), Ltd., 16, Great Eastern Street, E.C.2.

Viclaire. No. 479,727. Class 13. Ordinary electric lamps.—Michel Tchacon, Paris. (McKenna & Co., 31-34, Basinghall Street, E.C.)

Rheco. No. 476,148. Class 13. Electric lamps (ordinary), lamp fittings and shades, electric bells and fittings, electric switches and switch plates, wall and ceiling fittings, contacts and terminals, cut outs and similar electrical fittings and accessories, electric cooking and heating appliances.—Robinson & Hands Electrical Co., Ltd., 54, Barwick Street, Birmingham.

Insol. No. 478,945. Class 50. Radio-telegraphic fittings, and electrical fittings, all being goods made from condensation products of phenol and formaldehyde.—Die H. Römmler Gesellschaft, Berlin. (Wheatley & McKenzie, 40, Chancery Lane, W.C.2.)

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

BEXLEY.—44 bungalows, Pickford Lane, for the U.D.C.; W. T. Howse, surveyor.

BILLINGHAM.—Additional 120 houses, for the U.D.C.; surveyor.

BIRKENHEAD.—Police station and 16 houses, for the T.C.; C. Brownridge, borough engineer.

BIRMINGHAM.—Welfare centre, Charlotte Road, Stirchley; R. Fenwick, Ltd. 86 houses, Spring Road, Tyseley; W. Edwards, Contractors (Birmingham), Ltd. Extensions, Salvage depôt, Lifford; Muirhead, MacDonald, Wilson and Co., Ltd. Church, Tyseley; Bishop's Commission. Extension, Central Technical Institute, Suffolk Street; Education Committee.

BEXHILL.—Houses, Cooden Drive, Magdalen Road, and De la Warr Roads; Harrison Smith Buildings, Ltd.

BOLTON.—Palais de Danse, Bridge Street, and St. George's Road; W. Worsley.

BOSTON.—Wesleyan church, Sutterton; W. E. Norman Webster, architect, Spalding; S. Favell, builder, Kirton End.

CHATHAM.—Sewage pumping station, &c., for the T.C.; W. H. Radford & Son, engineers, Albion Chambers, King Street, Nottingham.

CHESTERFIELD.—Houses (50), for the T.C.; James Leaver and Sons, Ltd., builders, Sheffield.

COULSDON.—50 houses, Westleigh Avenue; U.D.C. surveyor.

COVENTRY.—Additional 98 houses, for the T.C.; E. H. Ford, city engineer. School hall, Radford (£3,198), for the Congregational trustees; Jervis Bros., builders. Extensions, Stoke schools (£15,000), for the City E.C.; the clerk.

DERBY.—Extension of boiler house at the Institution; H. Lea & Son, consulting engineers, 151-153, Edmund Street, Birmingham.

DEWSBURY.—Extensions, Mitchell Laithes Hospital, for the Joint Hospital Board; H. Dearden, borough surveyor.

DUMBARTON.—Clinic at Duntocher (£1,400), for County Council; the county clerk.

EASTBOURNE.—Development of Redoubt as music garden with shelters and bathing pool; borough engineer. Alterations, Cavendish Hotel, Grand Parade; Pimm Hotels, Ltd. 96 houses, Victoria Drive Estate; borough engineer.

EDINBURGH.—Conversion of building at 60, Princes Street into furniture warehouse for J. Woodhouse & Son; the manager. Aerated water factory at Hutchison Road; Mr. Alexander Robb.

FALKIRK.—Infirmary (£100,000); W. J. Gibson, O.B.E., architect.

GLASGOW.—Two schools, Knightswood; Education Committee. 96 tenements, Parkhead; housing director. Academy of music; Sir D. M. Stevenson, Bt.

GRAVESEND.—Alterations, Wellington Brewery, Wellington Street; Charrington & Co., Ltd.

HANLEY.—Extensions, Foundry Street; Sentinel Newspaper Co.

HEDNESFORD.—Catholic church (£30,000); Harrison and Cox, architects, Birmingham.

HEMSWORTH (YORKS.).—Laundry, for the Joint Hospital Committee; W. T. Lynam, architect.

HILL & CAKEMORE.—School (£16,935), for Worcestershire E.C.; W. Jackson, builder, Langley Green, Oldbury.

HULL.—Heating at Mental Hospital; Rosser & Russell, consulting engineers for Corporation. 120 houses, New George Street clearance scheme; city architect.

HUTHWAITE.—Housing scheme (44), for the U.D.C.; G. Bostock, surveyor.

ILKESTON.—80 houses, Rutland Estate, and 76 on Southern Estate; borough engineer.

IRISH FREE STATE (CORK). Carnegie library; P. Monahan, city commissioner.

IRLAM (LANCS.).—Housing scheme (40), for the U.D.C.; surveyor.

KIDDERMINSTER.—Model dairy (£5,000) for Co-operative Society; secretary.

LANARKSHIRE.—Extensions to County Hospital, including two pavilions (104 beds), operating theatre, and nurses' home extensions, for the C.C.; the clerk, Glasgow.

LEEDS.—Dance hall showrooms, &c. Sheepscar Street; Vernon Gash, Ltd. Weights and Measures offices, George Street; C. F. Bowman & Son, architects. Electric hare course, Elland Road; Leeds Greyhound Racing Association, Ltd. Billiard hall and dance hall, Kirkstall Road; W. Ogden. Palais de Danse, Roundhay Road; William Hill & Sons (Carriers), Ltd. Cinema, music hall, shops and ballroom, Harehills Lane and York Road; Shaftesbury Cinema (Leeds), Ltd.

LONDON (BARKING TOWN, E.).—70 houses, Shirley Road; J. R. Leftley.

(W.C.).—Theatre, Leicester Square. (£300,000). H. Day, M.P.

(ILFORD, E.).—Extensions, dust destructor works; borough engineer. Motor body works, Eastern Avenue; W. E. Oram. Research laboratories, Britannia Works, Roden Street; Ilford, Ltd. 30 houses, Clifton Road; P. Triplete.

(LEYTONSTONE, E.).—Dining hall, bakery and workshops, for West Ham B.G.; G. A. Allan, architect, 1, Staple Inn, Holborn.

(WEST HAM, E.).—268 flats, Memorial Estate, for the T.C.; borough engineer.

(E.C.).—Improved accommodation, police reserve offices, Bunhill Row; city engineer.

(FINCHLEY, N.).—110 houses, estate near Summers Lane; Harper & Smith.

(ST. JOHN'S WOOD, N.W.).—Block of flats, Park Road; H. W. Wills & W. Kaula, 22, Southampton Street, W.C.

(ST. MARYLEBONE, N.W.).—Extensions, Queen Charlotte's Hospital, Marylebone Road; governors. Extension of Regent Street Polytechnic in Titchfield Place (£170,000); trustees.

(WOOLWICH, S.E.).—53 houses, Eltham Estate; borough engineer.

(FULHAM, S.W.).—Garages site of 923-931, Fulham Road; G. R. Farrow, Amberley House, Norfolk Street, W.C.2.

(WIMBLEDON, S.W.).—Extensions, King's College School (£26,000), for the governors; the clerk.

MAIDSTONE (LEEDS).—Servants' hostel, &c., with electrical work, for the Hon. Mrs. Wilson-Filmer, Leeds Castle.

MALVERN.—Extensions, Assembly Rooms (£16,000), for the U.D.C.; surveyor.

MANCHESTER.—48 houses, Kingsway Estate, for Corporation; F. W. Woolfenden, Didsbury. Tramway offices, Failsworth; Corporation tramway manager. Dining hall, &c., Oxford Road Hospital; governors. Central heating at 32 school departments; Education Committee.

MAXWELLTOWN.—Extensions, High School, for Kirkcudbright E.C.; education architect, Castle-Douglas.

MORECAMBE.—Refuse salvage scheme; borough engineer.

MOTHERWELL.—Secondary school, Jerviston, for Lanarkshire E.C.; John Stewart, master of works, 20, Albert Street.

OLDHAM.—30 houses, Merton Avenue; W. Makin. Conversion Greenacres Lodge into maternity home; William Lees (Oldham), Ltd.

PRESTON.—Central schools, Deepdale, for the borough E.C.; B. Widdows, architect, Derby; George Hill & Sons, Ltd., builders.

QUEENZIEBURN (KILSYTH).—Housing scheme (40), for Stirlingshire C.C.; D. W. Glass, architect, 76½ Port Street, Stirling.

RICHMOND (YORKS.).—Bakery, garage and staff hostel, Catterick Camp; Navy, Army and Air Force Institute.

RIPON.—Proposed swimming baths, shelters, café, and theatrical stage for Spa; Corporation Special Committee.

ROTHERHAM.—Shops and offices, Corporation Street, for the T.C.; Vincent Turner, borough engineer.

ROTHWELL.—Secondary school, for West Riding E.C.; director of education, County Hall, Wakefield.

SHEFFIELD.—Housing scheme, fifth section, Longley estate; city architect. 36 houses, Dykes Hall Estate; city architect. New central library; city architect. Abattoir and wholesale meat market (£179,000); G. Longden and Son, Ltd.

SWINDON (WILTS.).—Hospital extensions (£25,000), for the governors of Victoria Hospital; secretary.

TANDRIDGE (SURREY).—Club house (£7,000), for the Golf Club; secretary.

TRUSTHORPE (LINCS.).—Hotel (£7,000); Messrs. Bush builders, Nottingham.

WHALLEY.—Nurses' hostel and extensions, Calderstones institution, for Lancashire Asylums Board (£31,000); the clerk, Preston.

WEST BROMWICH.—Drill hall and staff quarters, for Staffs Territorial Army Association; the secretary, Stafford.

YSTRAD MYNACH.—Central offices and 30 official residences, for the Powell Duffryn Co., Ltd.